This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

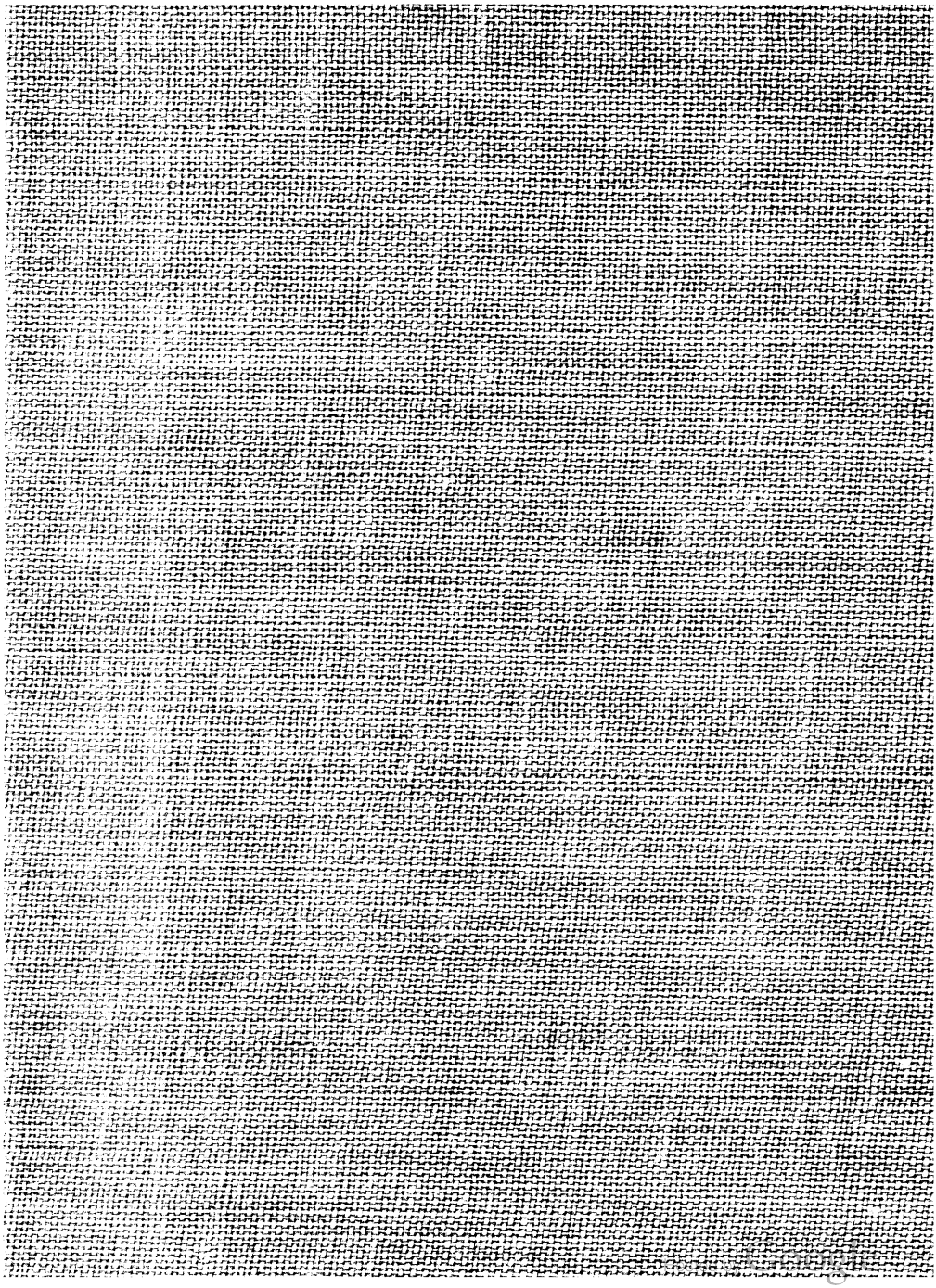
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

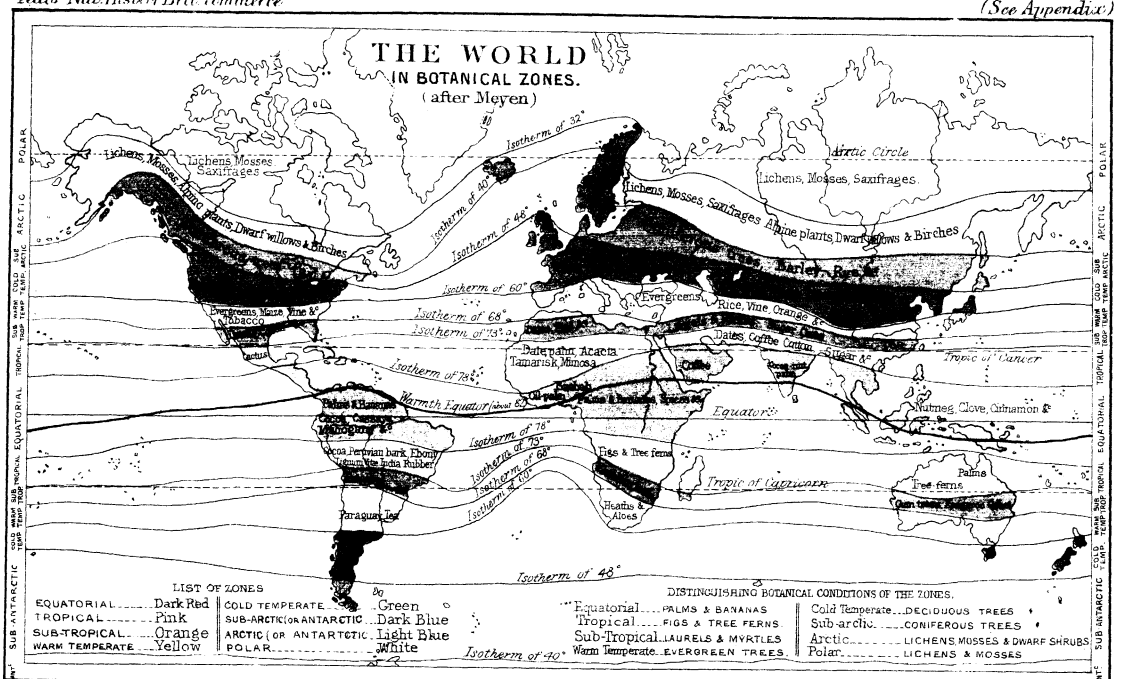
About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



Hosted by Google

Hosted by Google



Hosted by Google

GENERAL LIBRARY
University of
MICHIGAN

TECHNICAL, INDUSTRIAL, AND TRADE EDUCATION.

THE

NATURAL HISTORY

OF THE

RAW MATERIALS OF COMMERCE.

WITH A COPIOUS LIST OF COMMERCIAL TERMS
IN SEVERAL LANGUAGES.

BY JOHN YEATS, LL.D., ETC.

ASSISTED BY SEVERAL SCIENTIFIC GENTLEMEN.

NEW YORK:
SCRIBNER, WELFORD, & ARMSTRONG.
1878.

Hosted by Google

Hosted by Google

To

THOMAS SPENCER, ESQ.,

OF BRANSBY MANOR HOUSE, LINCOLNSHIRE,

WHOSE BEAUTIFUL MONOGRAPH ON THE VEGETATION AROUND SALEM SHOWS
HOW A SCIENTIFIC STUDY OF NATURE MAY ENNOBLE AND
ENRICH THE OWNERS OF A SOIL,

This Volume

IS AFFECTIONATELY INSCRIBED

BY

JOHN YEATS, LL.D., &c.

Peckham, Feb. 1st, 1871.

Hosted by Google

Hosted by Google

CONTENTS.

PART I.

Geography of the Home Country, the adjacent Continent, our Colonial Dependencies and Foreign Trade Connections.

CHAPTER I.

RAW MATERIAL. PAGE

The Meaning of the term Raw Produce.—Necessity of a knowledge of Raw Materials.—Original Discovery of Raw Materials and effects of Discovery.—How a Knowledge of Raw Materials can be obtained.—The Study of the Raw Materials of Industry must begin at home 1

CHAPTER II.

OUR NATIONAL HOME.

Climate.—Soil.—Consequences arising therefrom.—United Kingdom.—Great Britain.—Ireland.—British Empire defined.—Botanical or Floral Regions of Great Britain.—Chart 9

CHAPTER III.

GEOLOGY OF GREAT BRITAIN.

Effects of Geology on Agriculture 20

CHAPTER IV.

THE UNITED KINGDOM—IRELAND.

Its Raw Produce.—Mineral, Vegetable, Animal 42

CHAPTER V.

THE UNITED KINGDOM—GREAT BRITAIN.

Its Raw Produce.—Mineral, Vegetable, Animal.—Summaries and Charts 45

CHAPTER VI.

BRITISH FISHERIES.

Deep Sea Fisheries.—River Fisheries.—Shell-fish.—Whale Fisheries . 56

CHAPTER VII.

EUROPEAN ANALOGUES OF UNITED KINGDOM.

Analogues of Mining Industry.—Animal Products.—Vegetable Products 60

Hosted by Google

PAGE

CHAPTER VIII.

THE BRITISH EMPIRE.—BRITISH COLONIES AND POSSESSIONS.

General Description.—Considered in Climatic Zones.—Possessions in—1. Arctic and sub-arctic zones; 2. Temperate zone; 3. Sub-tropical zone; 4. Tropical zone.—Produce of these zones 61

CHAPTER IX.

FOREIGN PRODUCE.—EUROPE.

Origin of interchange.—European Produce.—Zones and sub-zones of European Produce.—Wine and Oil Countries.—Butter and Beer Countries.—Gradations in the Fauna and Flora 73

CHAPTER X.

ASIA.

Physical Conditions.—Raw Produce, Mineral, Vegetable, Animal.—Analogues in Southern Hemisphere 96

CHAPTER XI.

THE NEW WORLD.

North America.—South America.—Central America.—Physical Conditions.—Raw Produce, Mineral, Vegetable, Animal.—Chart of Temperatures and Produce 105

CHAPTER XII.

NATURE AND MAN AS AGENTS OF CHANGE.

Limits of Human Power in Nature.—Effects on Amount and Variety of Raw Produce.—Résumé 121

PART II.

The Commercial Products of the Vegetable Kingdom.

INTRODUCTORY.

I.—FOOD PLANTS.

1. *Farinaceous Plants.*

A. Products of Graminaceous Plants.

(a.) Cereals of temperate climates.—Wheat, preparation of flour, oats, barley, rye, ergot of rye 128

(b.) Cereals of warm climates.—Rice (rice paper), arrack, maize, guinea corn 132

B. Products of Leguminous plants.—Pea, horse-bean, French-bean, lentils, ground-nut, chick-pea, carob-bean or St. John's bread 137

Hosted by Google

PAGE

2. *Starches and Starch producing plants.*—Arrowroot, tous-les-mois, Zamia integrifolia, tapioca, sago 138
3. *Plants yielding Spices and Condiments.*—Cinnamon, bastard cinnamon, nutmeg, mace, cloves, allspice, pepper, long pepper, Cayenne pepper or capsicum, chillies, ginger, cardamoms, vanilla, aromatic fruits of umbelliferous plants, *e.g.*, caraway, coriander, anise, star aniseed, &c., mustard 141
4. *Plants yielding Sugar.*—Sugar-cane, beet, sugar-maple, and date . 155
5. *Plants useful in the preparation of nutritious and stimulating beverages.*—Tea, Paraguay tea or maté, coffee, cacao, (cocoa, chocolate), grape (varieties of wine, brandy), hops (beer) 159
6. *Plants producing wholesome and nutritious fruits.*
   A. Fleshy fruits.—Orange, bitter orange, lemon, citron, lime, grape, raisins, currants, fig, prune, French plum, date, pomegranate, tamarind, banana, plantain, pine-apple 178
   B. Nuts.—Hazel, walnut, hickory and pecan nuts, Brazil-nut, chestnut, sweet and bitter almonds, cocoa-nut 187
7. *Miscellaneous food plants.*—Onion, soybean, truffles, morel, and carrageen or Irish moss 191

II.—Industrial and Medicinal Plants.

1. *Textile plants.*—Flax, hemp, cotton plant, cotton shrub, cotton tree, jute, New Zealand flax, cocoa-nut fibre, Carludovica palmata, fibre of Manilla hemp 192
2. *Oleaginous plants.*
   A. Fixed oils.—Palm oil, castor oil, olive oil, rape seed oil, linseed oil, sesame oil, &c. 204
   B. Essential oils of lavender, thyme, peppermint, aniseed, caraway, cinnamon, clove, cassia, pimento, otto of roses, &c. 208
3. *Tinctorial plants.*—Alkanet, sumach, arnotto, myrobolans, saffower, logwood, madder, indigo, turmeric, quercitron, yellowberries, fustic, woad, weld, orchil, peach wood, sapan, or buckkum wood, red sanders wood 210
4. *Plants furnishing valuable building and furniture woods.*—Mahogany, ebony, East Indian ebony, boxwood, sandalwood, lignum vitæ, bird's-eye maple, American cedar, pencil cedar, lancewood, rosewood, black walnut, snakewood, satinwood, pine, fir, and larch 220
5. *Plants producing gums and resins.*—Canada balsam, caoutchouc, gutta-percha, tar, pitch, turpentine; gums arabic, senegal, and tragacanth, sandarach, gamboge, camphor, frankincense, assafœtida 225
6. *Medicinal barks.*—Peruvian bark, cascarilla, cedron, quassia . . 233
7. *Tanning materials.*—Oak-bark, valonia, galls, divi-divi, catechu, betel-nut 235
8. *Narcotic plants.*—Poppy, tobacco, strychnos 237

Hosted by Google

PAGE

9. *Miscellaneous medicinal products.*—Aloes, liquorice, ipecac, rhubarb, jalap, chamomiles, sarsaparilla, senna 242
10. *Miscellaneous products of commercial value.*—Vegetable ivory, coquilla nut, marking nut, tonquin bean, crabs' eyes, orris root, cork, balsa; plants yielding soda and potash, tinder, teazel, rattans, bamboo, bulrushes, rushes, Dutch rush, bast . . . 246

PART III.

The Commercial Products of the Animal Kingdom.

INTRODUCTION.

Object of a study of Natural History. Primary divisions of the animal kingdom 257

PRODUCTS OF THE CLASS MAMMALIA.

Classification of Mammals.

1. *Furs.*—Properties of furs, preparation and dressing of skins of animals, the process of felting hair and wool. Fur-bearing animals: *Carnivora*—Lion, tiger, leopard, jaguar, Canadian lynx, puma, cat, wolf, red fox, arctic fox, silver fox, ermine, Russian sable, mink, American sable, polecat, pine marten, stone marten, tartar sable, woodshock or pekan, beech marten, skunk, American otter, sea otter, black bear, polar bear, brown bear, grisly bear, raccoon, badger, glutton, seals. *Rodentia*—Beaver, musk-rat, coypu-rat or nutria, squirrels, chinchilla, hare, rabbit. *Ruminantia.*—Bison, lamb . 260
2. *Perfumes*—obtained from the musk-deer, civet cat, beaver, and sperm whale 278
3. *Stearine and oils.*—Tallow, spermaceti, whale, and seal oils . . 281
4. *Food products.*—Butter, cheese, lard, live stock, bacon, hams, salted beef and pork, preservation of meat 284
5. *Wool*, obtained from sheep; mohair, from the Angora goat; cashmere, from the Thibet goat; alpaca from the llama; wool producing countries 288
6. *Leather.*—Nature of leather, preparation of raw hides, tanning of skins, leather dressing, tawing leather (preparation of kid leather); preparation of russian and morocco leather. *Various kinds of hides used.*—Horse, deer, calf, sheep. Statistics 294
7. *Hair and bristles.*—Nature of; uses to which human hair, horse hair, hair of elk, goat, and camel are applied. Hog bristles, porcupine quills 298
8. *Horns and allied substances.*—Difference between horns and antlers, and nature of horn; animals which supply horn; various processes in the manufacture of horn; mode of colouring horn; articles into which horn is manufactured. Statistics. Hoofs, employment of. Whalebone, nature, preparation, and employment of.

Hosted by Google

PAGE

Osseous substances.—Antlers of various deer used in manufacture of knife-handles, &c. Ivory supplies, whence drawn, tusks and teeth of elephants, narwhal, walrus, and hippopotamus. Uses of ivory, and refuse of ivory (*noir d'ivoire*). Bone, uses in the arts, source of superphosphate of lime 301

PRODUCTS OF THE CLASS AVES.

Classification of Birds.

1. *Food.*—Flesh and eggs, edible nests 309
2. *Feathers.*—Composition and colour of feathers; ornamental feathers, those of the ostrich, little egret, great white and common herons, adjutant. Skin and feathers of penguin, puffin, grebe, swan, &c., worn as clothing. Bed-feathers obtained from natatorial birds, eider duck, goose, &c., and poultry-birds, as turkey, common fowl, &c. Quill-pens chiefly supplied by the goose, swan, turkey, &c., two kinds of quills, importation of quills and bed feathers . . 309

PRODUCTS OF THE CLASS REPTILIA.

Classification of Reptiles.

Turtle-flesh from the green turtle. Tortoise-shell from the hawk's-bill turtle 315

PRODUCTS OF THE CLASS AMPHIBIA.

Edible species, frogs, and axolotl 317

PRODUCTS OF THE CLASS PISCES.

Classification of Fishes.

Fisheries of herring, pilchard, sprat, whitebait, sardine, anchovy, mackerel, salmon, cod, and allied species; turbot, sole, and allied kinds; lamprey and sturgeon; caviare and isinglass. . . . 319

PRODUCTS OF THE SUB-KINGDOM MOLLUSCA.

Classification of Molluscs.

Dyes and pigments. Shells as ornaments, and economic uses of, mother-of-pearl, pearls, edible species, oyster, mussel, &c. . . 327

PRODUCTS OF THE SUB-KINGDOM ANNULOSA.

Classification of the Annulosa.

1. *Annelida.*—Leech 333
2. *Crustacea.*—Edible species, lobster, crab, &c. 334
3. *Arachnida.*—Spider and scorpion 334
4 *Insecta.*—Silkworm-moth, its metamorphoses, cultivation and manufacture of silk. Hive bee, natural history of; honey and wax. Blister-fly, cochineal, lac insect 334

PRODUCTS OF THE SUB-KINGDOM RADIATA.

Classification of the Radiata.

Red coral of commerce 346

PRODUCTS OF THE SUB-KINGDOM PROTOZOA.

Sponge, natural history of 347

Hosted by Google

PART IV.

Raw Mineral Produce.

I.—METALS.

PAGE

Iron: *Magnetic iron ore, titaniferous iron ore, red hæmatite, brown hæmatite, spathic ores, clay ironstones, other ores. Process of smelting, puddling, &c.; steel, supply of iron.* Gold, silver, quicksilver, platinum, tin, copper, lead, zinc, aluminium, antimony, bismuth, cobalt, arsenic, manganese, chromium (*with their chief ores, uses, localities, &c.*) 350

II.—MINERALS PROPER.

Coals and allied Substances.—Coal: *Lignite, bituminous coal, steam coal, anthracite. Supply of coal.* Jet, amber, *naphtha, petroleum,* asphalt, mineral pitch 367

Calcareous Substances.—Common limestone, ornamental limestones, and so-called marbles; marble, coral limestone, marl, calcareous sand, gypsum; *composition of limes, stuccoes, and cements* . . 372

Silicious Substances.—Rock crystal, quartz, and flint; sandstones, paving, mill, and building-stones; silicious sands, rottenstone, Bath bricks, Tripoli powder, Bilin powder, berg-mehl, tellurine . 374

Igneous and Metamorphic Rocks.—Granites: *Syenite,* mica, talc, asbestos, serpentine, basaltic rocks; *greenstone, whinstone, trap,* lava, obsidian, pumice-stone, pozzuolano, and trass . . . 376

Clays and allied Substances.—Common clay, yellow, brown, and blue; kaolin and petuntse, pipe clay, fire clays, *Stourbridge clay,* fuller's earth, red and yellow ochres, slates, hone stones . . 377

Earths of Sodium, Potassium, Boron, Sulphur, &c.—Common salt, rock salt, soda, *chlorine,* alums, natron, borax, saltpetre or nitre, cubic nitre, heavy spar, celestine, strontianite, fluor spar, sulphur, *sulphuric acid,* graphite or plumbago; mineral manures, *phosphates of lime* 379

Precious Stones.—1. Carbonaceous: diamond. 2. Aluminous: ruby, sapphire, emerald, topaz, corundum, garnet, beryl. 3. Silicious: amethyst, cairngorm stone, opal, sardonyx, agate, chalcedony, carnelian, jasper, lapis-lazuli, turquoise. 384

APPENDIX.

Vocabulary of the Names of Natural Productions in the Principal European and Oriental Languages 387

Geographical Distribution of Food and Industrial Plants. (*See Coloured Frontispiece*) 421

Glossary of the Principal Technical and Scientific Terms . . . 424

Hosted by Google

PREFACE.

In 1845 or '6, while residing in Holland, I was requested by an eminent Edinburgh firm to furnish them from the most authentic sources with an abstract of Dutch school literature. The kindness of a Minister of Instruction at the Hague, M. Wynbeck, enabled me to do this; and for the same firm I subsequently drew up, with the aid of M. Diesterweg of Berlin, a similar account of German school literature.

My attention was thus drawn to the characteristics of the school books used in countries possessed of systems of national instruction. The unity of purpose yet variety of design in these books struck me forcibly. One set of them seemed to me to be almost unrepresented amongst us, namely, books for young people who have left school. Such books were not "Steps" or "Guides," they rather inculcated self-support, and held out inducements to further culture. They were called "Fortbildungs Bücher." They facilitated the retention of knowledge already gained, and provided copiously for its increase. They illustrated the achievements of art and science, but also exhibited the defects in mechanical and manu-

Hosted by Google

facturing appliances. Persuasive in style and suggestive in thought, they appeared to me most valuable as well as agreeable.

The want of such books in England has become evident to me from correspondence with old pupils, upwards of a thousand of whom have left me now for business. To them and the public generally I have at length the pleasure of presenting a work, which is the substance of my own individual teaching in industrial matters, and, beyond it, that of abler men at home and abroad.

This task, not lightly undertaken, has occupied my leisure during many years. The plan, together with large portions of the whole work, were submitted to the late LORD BROUGHAM in 1862, and considerably modified by his lordship's suggestions.

Believing in the old adage, *Μέγα βίβλιον μέγα κακὸν*, I have studied brevity no less than precision.

JOHN YEATS, LL.D.

Peckham, London, 1870.

P.S.—Errors of omission and commission, made known to me by critics and private correspondents, have been rectified in the present Edition, to which has been added a short Glossary of Scientific Terms unexplained in the text.

J. Y.

Hosted by Google

INTRODUCTORY.

IT was once pointedly remarked, that "the addition of a new fact to a farmer's mind often increases the amount of his harvest more than the addition of acres to his estate." The principle holds good in every department of industry and commerce. Discoveries of new forms or properties of matter, or fresh applications of old ones, of new motive-power or of new mechanism, are continually changing the aspect of affairs. A new tool even will sometimes add immensely to the value of an old material, develop some branch of industry to an extent hitherto unthought of, and thus promote the comfort of millions. Fifty years ago few workmen could accomplish the cutting of common window-glass without risk and loss; at length a thoughtful observer found out that there was one direction in which the diamond was almost incapable of abrasion or wearing by use, and he contrived the present simple tool, which steadies the diamond and retains it in the direction required.

Hosted by Google

Here was a discovery resting upon a scientific principle. It might, and probably would, have been made much earlier had an acquaintance with science, or with *the systematised knowledge of matter and its properties*, been more common. The complaint is now general that this knowledge is less frequently met with amongst us than it should be, while our Continental neighbours are so sensible of its advantages, that they are providing it liberally for every man, woman, and child within their reach. They feel that it is in itself property, and the prolific source of wealth. They see that it cannot be carried off by an enemy, or impaired by bad seasons, or paralysed by a panic. They find that it costs nothing to defend or to insure; that it is not merely a circulating commodity yielding a single profit to its possessor, but rather fixed and constantly productive capital. Therefore, beyond primary schools, they provide industrial schools, trade schools, polytechnic schools, drawing schools, museums of art and manufacture, to all of which access is nearly free, and attendance on some of them almost compulsory.

In the following pages, which comprise the geography and the natural history of raw materials, an attempt is made to supply young Englishmen engaged in mercantile pursuits with such knowledge

Hosted by Google

of the earth and its productions as is regularly afforded in the Handels-Schulen of Leipsic, Berlin, Antwerp, and Amsterdam. In them the future Dutch or German merchant is taught to look beyond the limits of the Zollverein, and to regard the world at large as a vast storehouse, with the contents of which he must make himself familiar. At school he studies the sources of supply for the goods he must hereafter deal in. A counting-house, he is told, is a place in which he will be expected to *use* his knowledge, *not to seek it.* He is first made acquainted with the laws and conditions of soil and climate, and then brought into contact with specimens of produce from the different kingdoms of nature; these he is required to examine and describe methodically. He is habituated to the use of scientific nomenclature, which is suggestive not merely of natural relationship among things, but of their chemical composition and other valuable properties. Thus, from the outset of his business career, he is accustomed to accurate as well as comprehensive views; also to a kind and degree of intellectual discipline that must beneficially affect his progress; for, finally, he is informed that:—"The earth was made to be the home of mind, soul, character, and man was created to make this earth tributary to his largest growth in mind, and soul,

Hosted by Google

and character. In this sense the earth and its noble possessors are correlative. Each individual rises to his own appointed work, runs his own course, uses all the appliances of nature, all the help with which God invests him, and then ceases from his mission here; but the earth remains, the home of advancing millions, helping them all onward, and granting them new power to fulfil the noble purposes of human life." *

* Carl Ritter.

Hosted by Google

THE NATURAL HISTORY

OF THE

RAW MATERIALS OF COMMERCE.

CHAPTER I.

RAW MATERIAL.

What is meant by Raw Produce—The Necessity of a Knowledge of Raw Materials—The Discovery of Raw Materials, and the Effects of Discovery—How a knowledge of Raw Materials can be gained.

In the earth, with its oceans of water and of air, we find those natural resources from which, chiefly, we draw the means of material support. The produce of its teeming waters, the animals and plants upon its surface, furnish us with food and clothing; the stone, the metals, and the coals laid up in its crust, supply us with the means of shelter, with various implements, and with fuel. Several facts connected herewith are part of our earliest experience. 1st. There is in the world an indefinitely large number of substances adapted to our service in health and in sickness. 2nd. These substances are distributed so that each region has its special treasures. 3rd. The inhabitants of any one region may, by exchange, become possessed of the abundance and variety of all other regions; if, for example, the Norwegian has plenty of timber, but a scarcity of wool, and thus finds himself well housed, but poorly clad, while the English-

Hosted by Google

man has woollen cloth to spare, but wants timber for building, each may, by interchange, be well clothed and well housed.

In speaking of the natural resources of any country, we refer to the ore in the mine, the stone unquarried, the timber unfelled, the native plants and animals—to all those latent elements of wealth only awaiting the labour of man to become of use, and therefore of value. To the expression *Raw produce*, however, an extended meaning is assigned. We do not merely gather in the indigenous materials of the country where we live, but, by intelligent industry, we increase the natural production. Tillage and cattle-rearing procure for us a greater abundance of corn and fruit, and flesh-food, and textile fibres than we should otherwise enjoy. This increase, and all the crude constituents of wealth, whatever their origin, come under the designation of *raw produce*, or, in commercial language, of *raw materials*.

Without a considerable knowledge of raw materials, and of their adaptations, we could not live; and without an unremitting application of such knowledge we could not live in comfort. We may even measure a country's civilisation by the extent and diffusion of this important knowledge. Barbarous tribes pass their time in providing for their recurring appetites, and cannot be said to enjoy existence, in the sense of mental enjoyment. Where such tribes do not die out, their numbers, at the best, remain stationary. Among civilised nations, knowledge is increased; and many things, which in some parts still remain to be discovered, have in other parts become the necessaries of life for populations doubling and trebling in a century.

The economic history of a nation would be a record of the discovery of new raw materials, of new sources of supply,

Hosted by Google

and of additional applications. All such discoveries tend to our benefit, while their result is occasionally to enrich the discoverer, and to change the face of our social and industrial life. It has been said that he who makes two blades of grass grow where only one grew before is a benefactor to his species. The truth of this statement is easily proved. Take the single example of wheat, and imagine the blessings which a double produce of this grain alone would confer upon mankind.

The manifold uses of coal afford remarkable instances of the effects of discovery. Though Corinth produced what we might call Birmingham and Sheffield wares, and Athens was the centre of such manufactures as we now find divided between Leeds, Staffordshire, and London, yet coal was not employed by the Greeks and Romans; it was not used as fuel, even at Newcastle, till the thirteenth century, and it crept into general use only during the reign of Elizabeth. This one material has been the main cause of a complete revolution in our national industry. It is but a generation or two since, by means of coal, a new motive-power, steam, was evoked, and native wrought-iron was first extensively applied to mining, to machinery, and to locomotion. Now every civilised country is scored with railroads, cities are lighted with gas, and coal and iron promise to change the character of our ships and our mariners. Before coal was used to generate steam, the sites of manufacturing towns were determined chiefly by the convenience of mill-streams, and the woods were the seats of smelting. The forest fires are now extinguished; the fabrication of iron has travelled to the coal-fields, which have become the most densely-peopled parts of the kingdom, and the scenes of the busiest industry. Wool, once the staple industry of England, is now second in magnitude and importance as compared with cotton; yet, with the

Hosted by Google

discovery of new sources of supply, and with increased home production, the quantity made into clothing is vastly greater than in former times. On the Continent, the introduction of the silkworm, more than a thousand years ago, gave rise to the unrivalled manufactures of the South of France, and originated one of the chief elements of the wealth of Italy and Greece. The dyeing of textile fabrics leads us into the domain of chemistry, a subject requiring a volume merely to name its discoveries. Indigo has displaced woad as a blue dye; and the new aniline colours, outvying the Tyrian purple, elevate our taste and gratify our sense of beauty. If we take other examples, similar facts appear. The Chilian potato has provided food for many millions of people, and in 300 years has reached in Europe a perfection to which in its native soil it never approached. Maize has become an important crop round the Mediterranean; while wheat, which was given to America in exchange, has flourished there so greatly as to admit of large exports to the Old World.

Discoveries of the utmost value appear, for a time, of less significance, because their full development is not at first realised or foreseen. It is not easy for us to determine how far the industrial and social habits of posterity may be influenced by the production of the hydro-carbons and mineral oils. From the first employment of caoutchouc for rubbing out pencil-marks, its applications have been manifold. In gutta-percha we see applications of a new raw material to telegraphy, embracing the world. We have only to contrast the present period of our history with any former period, or the condition of any one country with another, to perceive the effect of such knowledge upon human well-being. Every year adds to our list of useful animal, vegetable, and mineral substances; while the increasing consumption of those already known calls forth, as a rule, increased

Hosted by Google

production. Thus, the importance of a knowledge of raw materials cannot be overrated. It is a matter of personal interest to everybody in every part of the world. It must not be forgotten, however, that no amount of abstract reasoning would have led us to discover the properties and uses of iron, without first seeing, handling, and examining a piece of that metal. Experiment precedes the growth of knowledge. Every discovery of a new material, or a new property of an old material, has suggested new uses; and fresh necessities have led continually to fresh researches. Dyeing, tanning, brewing, glass-making, and weaving were known to the Egyptians in very ancient times, ranging from 1,500 to 2,500 years before Christ. These industrial operations involved a prior discovery of the raw substances operated upon. Indigo and purple dyes, bark and other astringents that effect the change of skin into leather, barley and malt, silicious sands and alkalies that, admixed, form glass — silk, linen, and cotton woven in primitive ages—must all have made part of the earliest human history; and passing over a long interval, we read of quills being used for writing (A.D. 600), of the use of sugar among the Arabs (A.D. 850), of coffee among the Persians (A.D. 875), &c. &c.

Without extending the list, we may dwell upon the thought of how much we owe to the past, even in these few selected instances. The same methods that rewarded our ancestors with fruits of discovery must be still followed by us in order to add to their number. Our forefathers observed, compared, tested, and applied, age by age, the gifts of nature, and bequeathed to us the accumulated stores of their experience. To come into possession of a complete knowledge of economic substances, our inquiries must begin early, and at home. Here the articles are at hand, and we are accustomed to the use of them; though

Hosted by Google

with imports from all parts of the earth, it has become difficult to say whether we are most interested in our own, or in foreign produce. In England, the facilities for study surpass those of other nations, and we may reverse the usual steps of inquiry, and endeavour, from the raw substance itself, to arrive at the conditions of its being as well as its essential characteristics. What we know of the undeviating laws of nature opens our minds to inferences and generalisations whenever a basis of facts is broad enough to support a correct induction.

In the vegetable kingdom, we see the distinction between *endogens* and *exogens* clearly marked from the cotyledons through the whole life-history of the plants. The structure of the stem, the veining of the leaves, the number and character of the floral organs, all differ persistently in the great sub-kingdoms. A worker in wood will tell, from the texture and grain, not merely the species but the variety of tree, and the place of its growth. A mahogany merchant will distinguish the timber of Cuba from that of other West Indian territory, and island growths from those of the mainland. Again, the starches existing in so many plants are distinguished from one another by the form of their grains, so that potato-starch mixed with arrowroot can be easily detected; and flour of every kind indicates in the same way the grain from which it was prepared. The microscope shows an identity of structure between the nutmeg or hard kernel, and the arillus or mace, that enwraps it, and would prove that the two substances belong to each other, greatly as they differ in appearance, even though their relationship were not otherwise known. In a general way, if we see a rattan, bamboo, or palm stem, we at once know it to be an exotic, or tropical production; and we infer, from the ferns and calamites of the Coal Measures, that the beds of shale and coal originated under

Hosted by Google

conditions of climate quite different from those now prevailing in the temperate and frozen regions, where they are found.

Examples abound equally in the animal kingdom. We do not hesitate to draw climatic inferences from the presence of the bones of certain fossil carnivora in cold regions, although such inferences receive no support from the existing climate. With living animals we can usually trace their geographical relation, and say, *this* is a tropical bird, fish, or insect; *that* belongs to the frigid zone.

The more minute our investigations, the more is this law of the individuality of every natural product, and of the mutual adaptation of all the conditions of existence, confirmed. The structure of a bone enables naturalists to build up the animal of which it is a part, to describe its habits, and to fix its proper position in the vertebrate series. Professor Owen has demonstrated that the dental or tooth structure of every species of animal is distinct, and that, were our knowledge comprehensive enough, it would unerringly guide us to the identification of the animal.

From these illustrations, it will be seen that all raw substances contain within them structural evidences of the conditions under which they were developed; and that by a scientific induction, possible only with increased knowledge, we may learn to read these evidences, and to apply our knowledge to the improvement of the substance—that is, to its increased utility. Books will not only show the knowledge already acquired, but they will direct the student in his search for more. The history of discovery shows how advances have been anticipated, how new powers or properties were generally suspected, and how they revealed themselves in answer to scientific interrogation. Herein we perceive the utility of museums, where economic substances from the three kingdoms of nature are classified for comparison and

Hosted by Google

study. In every civilised country there are museums; and every school should also be a repository of specimens of raw produce, in the nature and use of which direct instruction should be given. Early familiarity with the substances themselves would lay the foundation of knowledge, which would not only save the young man of business the first weary years of learning, but would send him forth into the domain of nature, perhaps as a discoverer of new materials, or of new properties or adaptations, adding to the necessaries and conveniences of life, and therefore to the health and happiness of mankind.

Hosted by Google

CHAPTER II.

OUR NATIONAL HOME.

Our National Home—Its Climate, Soil, and Consequences resulting therefrom—Latitude of the United Kingdom and Contrast of Corresponding Latitudes—Position of the United Kingdom relative to Europe—Diversities of Temperature—Diversities of Rainfall—Causes of Diversity—Gulf Stream—Deflection of Isotherms—Current and Counter-Current—Aërial Currents—Botanical or Floral Regions—Iberian or Asturian, Armorican, Germanic, and Boreal Regions—Minor Diversities of Climate and Vegetation—Chart of Floral Regions.

The United Kingdom, between 50° and 60° N. lat., by 2° E. and 11° W. long., comprises several hundred islands, of which Great Britain and Ireland are the chief, the remainder being relatively unimportant.

Great Britain, including England, Wales, and Scotland, is the largest island in Europe.

The British Empire comprehends, besides the United Kingdom, colonies and possessions in every zone, so extensively and widely dispersed as to give literal truth to the saying that the sun never sets on the Queen's dominions.

The latitude of the United Kingdom corresponds with that of the cold and sterile regions of Labrador, in America, and the ice-bound shores of Kamtschatka, in Asia. In the southern hemisphere its like or analogue is the cheerless land of Tierra del Fuego. London is in the same latitude as the strait of Belleisle and Cape Lopatka; Edinburgh, the northern metropolis, corresponds with Moscow, and also with Cape Horn.

These are striking contrasts. We cannot imagine a flourishing people living in the bleak and pitiless countries just referred to. From what, then, are our immunities

Hosted by Google

derived? A well-known American writer says of England:—

"The territory has a singular perfection. The climate is warmer by many degrees than it is entitled to by latitude. Neither hot nor cold, there is no hour in the whole year when one cannot work. The temperature makes no exhaustive demands on human strength, but allows the attainment of the largest stature. In variety of surface it is a miniature of Europe, having plain, forest, marsh, river, sea-shore; mines in Cornwall, caves in Derbyshire, delicious landscape in Dovedale, and sea-view at Torbay; highlands in Scotland, Snowdon in Wales; in Westmoreland and Cumberland a pocket Switzerland, in which the lakes and mountains are on a sufficient scale to fill the eye and to touch the imagination.

"From first to last it is a museum of anomalies. This foggy and rainy country furnishes the world with astronomical observations. Its short rivers do not afford water-power, but the land shakes under the thunder of its mills. There is no gold mine of any importance, but there is more gold in England than in all other countries. It is too far north for the culture of the vine, but the wines of all countries are in its docks; and oranges and pine-apples are as cheap in London as in the Mediterranean."*

RELATIVE POSITION OF THE UNITED KINGDOM.

Great Britain is insulated from the continent by the arms of that ocean which forms the western boundary of Europe. For about a hundred miles west of Ireland the slope of the sea-bed is gradual, when a sudden descent occurs of more than 2,000 feet, forming submarine cliffs that mark the confines of the Old World. The bed of the German Ocean, on the other hand, is generally shallow. Its average depth is not over thirty or forty fathoms, which

* "English Traits." By R. W. Emerson.

Hosted by Google

would not cover the chimney-shafts of many of our factories, and in no part are the soundings deep, except off the precipitous coasts of Norway, which the Atlantic, rather than the North Sea, may be said to lave. Traversing this sea are also many shoals and sand-banks, the largest being the Dogger, 350 miles long, running northward, midway between the coast of Northumberland and Jutland. Some of these banks come within six or seven fathoms of the surface.

The neighbouring lands on both sides of the German Ocean assume the features of the sea-bed. Parts of Holland are forty feet below the sea-level, and are only protected from marine irruptions by embankments and sand dunes. Jutland is entirely alluvial. "English Holland," or the Fen districts in the neighbourhood of the Wash, consists of land reclaimed from the sea, much of it so low-lying as also to require dykes and embankments to prevent inundation. In fact, the great European plain commences in the tertiary and alluvial deposits of the East of England, takes in the German Ocean, embraces the Netherlands and Denmark, then sweeps along the low lands and stoneless steppes below St. Petersburg, and extends to the Caspian Sea. The whole plain gives evidence of an ancient sea-bed, of which the sandy flats about Calais and Berlin, and the lake-plain of Pomerania, are parts, and with which England is conjoined. The United Kingdom consequently retains, in many respects, a European, although insular, character.

CLIMATE OF THE UNITED KINGDOM.

"Climate," says Professor Ansted, "is a resultant of all the atmospheric phenomena, embracing the temperature of the air at various times and seasons, the range and variation of the temperature, the direction and force of the prevalent winds, the liability to storm, the amount of humidity in the air at various seasons, the quantity of mist and rain, the distribution of rain, and the varieties of electrical condition.

Hosted by Google

"These phenomena affect and depend on each other, but all may ultimately be traced to certain general causes.

"1. The position of the station in latitude.

"2. The size and figure of the land on which the station is situated, whether detached island, archipelago, or continent.

"3. The elevation of the station above the sea.

"4. The position of the land on which the station is placed, with reference to the neighbouring land.

"5. The position, distance and direction, magnitude and elevation, of the nearest continent.

"6. The nature, magnitude, and direction of the nearest great marine current to its shores."

The phenomena of the climate of the United Kingdom may be summarised under the heads of Diversities of Temperature, and Diversities of Rainfall.

I. Diversities of Temperature.

The western coast of Ireland is 10° warmer than the east coast of England on the same parallel of latitude. Scotland, compared with England, is cold and wet, although not subject to extremes. The winters, indeed, are so mild that the harbours generally do not freeze, as in similar and even in lower latitudes on the Continent. The Western Islands have a uniform and genial climate, contrasting with the opposite coast. Unst, one of the Shetlands, and the Isle of Wight, correspond in winter temperature, although separated by nearly 700 miles, or 10° of latitude.

Again, Devonshire and Cornwall, in point of winter temperature, are warmer than London by 5°; Penzance and Torquay, in mildness and salubrity, resemble Madeira, and are recommended to patients affected with pulmonary disease.

The diversities of temperature are tabulated in the following chart:—

Hosted by Google

Great Britain, East Side.

Locality.	Latitude.	Winter Temperature.	Summer Temperature.	Mean Temperature.
		Fahrenheit.		
Unst . . .	60° 45′ N.	38·6°	52·6°	44·7°
Wick . . .	58 29	38·8	55·3	48·9
Inverness . .	57 28	35·0	57·0	47·7
Aberdeen . .	57 8	39·0	59·5	49·2
Dundee . .	56 27	41·4	63·4	51·9
Leith . . .	55 59	40·5	58·2	48·3
York . . .	53 57	36·2	62·3	49·2
Bedford . .	52 8	40·5	62·8	51·6
London . .	51 30	39·5	62·9	50·8
Chichester . .	50 5	38·8	60·7	49·5

Great Britain, West Side.

Locality.	Latitude.	Winter Temperature.	Summer Temperature.	Mean Temperature.
		Fahrenheit.		
Glasgow . .	55° 51′ N.	39·6°	60·1°	49·8°
Whitehaven .	54 33	39·9	59·6	49·0
Isle of Man .	54 15	41·7	59·1	49·8
Liverpool . .	53 24	41·3	61·1	50·8
Swansea . .	51 36	45·5	60·6	53·7
Penzance . .	50 7	44·2	60·9	51·7

Ireland.

Locality.	Latitude.	Winter Temperature.	Summer Temperature.	Mean Temperature.
		Fahrenheit.		
Belfast ...	54° 36′ N.	41·4°	63·9°	52·3°
Antrim ...	54 43	36·7	58·1	47·7
Dublin ...	53 21	39·8	59·6	49·7

Mean Temperature of the whole Coast.	Winter.	Summer.	General Mean.
West Coast of Great Britain.	40·3° Fahr.	59·0	49·0°
East Coast of Great Britain .	38·2	59·0	

Mean Temperature of hottest month (July), 60·0° to 65·0°.
Mean Temperature of sea on West Coast in winter is 41·0°.

II. Diversities of Rainfall.

Constant humidity, rather than amount of rainfall, distinguishes the United Kingdom; for the total rainfall is

Hosted by Google

not actually greater than that of many other countries on the same latitude. Nevertheless, we owe to it our numerous rivers, and the fertility which makes nearly the whole land resemble a garden. Ireland is more humid than England, and the western side of both islands is more humid than the eastern. As a consequence, Ireland is essentially a grazing country, and in England pasturage is more common in the western than in the eastern counties, where tillage chiefly prevails. These facts are patent in the familiar terms of Irish butter, Devonshire cream, Cheshire and Gloucestershire cheese, Hereford shorthorns, Alderney cows; while Norfolk and Suffolk and the valley of the Thames are suggestive of corn.

At Keswick, Cumberland, the yearly average rainfall is 60 inches; in London, the average is 24 inches. The average for the whole of the United Kingdom may be between 30 and 40 inches.

The following diagram will give a better view of the rainfall.

DIAGRAM OF THE RAINFALL OF THE UNITED KINGDOM.

Ireland.

EAST SIDE.		WEST SIDE.	
Londonderry ...	31·0 inches.	Westport, Mayo ...	46·0 inches.
Belfast	35·0 ,,	Cahirciveen ...	59·0 ,,
Dublin	30·8 ,,	Cork County ...	40·0 ,,
Portarlington ...	23·0 ,,	Castletownsend ..	42·0 ,,
Mean of Coast and Interior ...	29·7 ,,	Mean of West Coast and Interior ...	47·4 ,,

Great Britain.

EAST SIDE. *Coast and Interior*		WEST SIDE. *Coast and Interior.*	
Inverness	27·0 inches.	Cape Wrath ...	38·6 inches.
Edinburgh ...	25·0 ,,	Rothsay	48·0 ,,
W. Denton, Northumberland ...	36·8 ,,	Glasgow	33·6 ,,
York	24·0 ,,	Lake Districts from	50·0 to 140·6 ,,
Bedford	31·7 ,,	Liverpool	34·7 ,,
London	24·0 ,,	Swansea	35·4 ,,
Hastings	31·0 ,,	Penzance	43·0 ,,
Isle of Wight ...	30·9 ,,	Bath	32.0 ,,
Mean of East Side, &c.	27·4 ,,	Mean of West Side, &c.	45·5 ,,

Hosted by Google

III. Causes of Diversity.

Our western shores are bathed by an ever-flowing warm current from the Atlantic, called the Gulf Stream. The winds, for more than two hundred days in the year, blow in the track of this great marine current, and fill the air with humid vapours exhaled from its surface. The Gulf Stream originates in the embayed waters of Mexico, whence, heated and expanded by a tropical sun, it issues as an ocean river through the Narrows of Florida. Widening in its course northwards, it divides in mid-Atlantic. One current curves to the north-west coast of Africa, and becomes lost in the equatorial waters. A polar prolongation, accurately defined, diverges till it fills the space between Iceland and Norway. By its influence the North Cape is freed from ice even in the depth of winter, and its effects are felt as far as Spitzbergen, where its interfusion with the surrounding ocean becomes complete.

The United Kingdom fully receives the beneficial influences of this stream. The warm air and heated flood combine to deflect northward the isothermal lines*, raising the temperature, and giving to high European latitudes the amenities of a southern climate. Now, it is a physical law that every current, whether aërial or marine, has a corresponding counter-current. We find, therefore, firstly, that at an undefined distance to the west, a cold stream flows down Baffin's Bay, and past the Greenland shores, sinking by its density beneath the Gulf Stream, and completing its circuit; secondly, that to the east a polar counter-current blows over the distant Russian plains to complete the aërial circuit. Thus we are twice favoured: by the presence of the warm, genial currents, and by the absence of the arctic, inclement counter-currents, which respectively determine the climate of their neighbourhood. While the western

* Lines laid down on maps to connect places which have the same *mean* temperature, or which are on parallels of equal seasonal temperature.

Hosted by Google

maritime borders of Europe are verdant, the coasts of Labrador are frost-bound and barren; and the region of the intensest cold on the globe is in the Russian dominions.

At the time of the vernal and autumnal equinoxes the aërial streams in the latitude of the United Kingdom come into conflict; the cold easterly and north-easterly winds condense the vapours from the ocean, and produce characteristic fogs. These winds are trying, and often prevail for weeks together.

BOTANICAL OR FLORAL REGIONS.

Within the confines of the United Kingdom various botanical or floral regions have been defined with tolerable accuracy, each region being characterised by its own climate.

Our cloudy sky keeps off heat, prevents radiation, and is favourable to the growth of crops whose variety makes up for the greater certainty of the harvests of the Continent. Though we do not enjoy uninterrupted fine weather, there is scarcely a day, except at the equinoxes, when the sun does not shine; and we rarely suffer from a succession of bad seasons.

I. Iberian or Asturian Region.

In the part principally open to the Gulf Stream and to the prevalent winds, the air is so charged with moisture, that the sun's warmth is absorbed before reaching the earth, and fruits that will ripen farther north here seldom come to perfection. The peach tribe lose flavour, and grapes never reach maturity. The crops suffer less from drought than from too much wet. Botanists designate it as our Asturian or Iberian region, from its relation to the Asturias, the Biscayan province of Spain. The Arbutus, London pride, three heaths, Maiden-hair fern, and about seven other species of plants not occurring in any other part of Great Britain, are found in this botanical region. The provinces

Hosted by Google

of Munster and Connaught in Ireland, and the county of Cornwall, with the adjacent parts of Devonshire in England, represent this region. Myrtles are fragrant in the open air throughout the winter. The evergreen Oak, and the Arbutus, are prominent in the overhanging woods of Killarney, where they were planted by the monks of Mucross. A rich neighbouring strip of land running through the two counties of Tipperary and Kilkenny, has for centuries borne the proud name of the Golden Vale, and produces, every season, abundant crops.

II. Armorican Region.

The south-west of England, adjoining Devon and Cornwall, agrees in climate with the French provinces of Normandy and Brittany, the flora of which is not prevalent elsewhere in the United Kingdom. Devonshire cyder and Worcestershire perry indicate the English home of the apple and pear. "Normandy pippins" is an equally familiar term. Across the Channel the rural homesteads, the pastures, and orchards continue the natural aspect of England; while the Oak, Ash, and Elm lend effect to the picture. Brittany, trending into the Atlantic, is even like Ireland in humidity and warmth. This district of France, the ancient Armorica, gives a designation to the English botanical region.

III. Germanic Region.

The vegetation of the midland and eastern parts of the United Kingdom, overlapping likewise every other floral division, bears a close relation to that of Central Europe, and comprises the most important and numerous plants. It is the region of deciduous trees, or such as lose their leaves annually, and includes our chief varieties of timber, with an undergrowth of wild apple, cherry, holly, hawthorn, broom, furze, wild rose, bramble, and honeysuckle. Food-crops, both of corn and roots, here reach their highest perfection, and every kind of pulse and green vegetables,

Hosted by Google

such as peas, beans, the turnip, carrot, potato, and cabbage, grow in abundance.

IV. Boreal Region.

Farther north, the Scottish Highlands approximate in character to Scandinavia, the features being partially shared by the hills of Cumberland and Westmoreland. Vegetation greatly differs from that of the plains, and is analogous to the dwarf progeny of the snow-clad Alps, or of Arctic lands. Hence its botanical name, the Boreal or Scandinavian Region. The favoured parts of Sweden, and even of Lapland, are so nearly alike in soil and climate to Great Britain, that three-fourths of their vegetation are common to this country. While, however, our islands are nearly bereft of forests, and even England has yielded much of its forest land to the exigencies of husbandry, Sweden is covered with trees, and Lapland's woods are the chief source of its wealth. On the other hand, the summer scene presented by the wide-stretching archipelago upon which Stockholm is founded might be transferred to the balmiest part of the English coast; for the larks of those islets fill the air with song, and the ground is matted with wild strawberries, interstrewn with bright pinks and dog-daisies, while wild thyme, meadow-sweet, and other fragrant plants, scent the air.

The prevalence of plants in groups has enabled us not only to define botanical districts or floral regions, but also to distinguish climate within short distances. If every condition were easily traced, the climate of any spot could be at once inferred; but our own country exemplifies the difficulties of accounting for the differences of climate in small areas. Brighton differs essentially from Torquay; Bath from Cheltenham; the climates of Malvern, Buxton, and Harrogate are unlike those of Scarborough and the Lake districts; and each in turn differs from all the rest. It would be a good mental exercise to trace the local or distant cause of these diversities.

Hosted by Google

CHART OF FLORAL REGIONS OR BOTANICAL DISTRICTS.

Region.	Limits.	Characteristics.	Analogue.
Iberian or Asturian.	S. W. Ireland, Cornwall, and Devon.	Humidity. Evergreens.	Madeira and N. Spain.
Armorican.	S. & W. England, Channel Islands, S. E. Ireland.	Pastures and Orchard Fruits.	Normandy and Brittany.
Germanic.	N. & Central Ireland, Central England, Scotch Lowlands.	Deciduous Trees and Green Vegetables.	Germany and Mid-Europe.
Boreal, Arctic, or Scandinavian.	Extreme N. Ireland, Scottish Highlands, Eng. Lake District.	Fir Trees and Berries.	Alps, Sweden, Lapland.

Hosted by Google

CHAPTER III.

THE EFFECT OF GEOLOGY ON THE INDUSTRY OF THE BRITISH PEOPLE.

Introduction—General Physical Geography of England as dependent on its Geology—Geological Distribution of Mineral Products—Minerals in Veins—Influence of Igneous Rocks on the Development of Minerals in Veins—Bedded Mineral Deposits—Coal and Iron, and Association of, in their Relation to Industrial Pursuits—Relation of Geology to Agriculture—Botanical Aspect presented by Geological Formations—Influence of Certain Constituents of Rocks on the Growth of Plants—Comparison between other Countries and Parts of Great Britain—General Summaries.

THE soils of a country necessarily vary with the varying nature of the subjacent strata; and to appreciate the influence of the former on the industry of the inhabitants of any particular district, its geology must be carefully studied; for, apart from climatic effects, the constituents of different soils determine, to a great extent, the distribution of plants. The attachment of some species of these to certain kinds of rock is illustrative of the statement. *Arenaria Norvegica*, *Cerastium alpinum*, and *Arabis petræa* are confined, in the Shetlands, to serpentine rock; *Orobanche rubra*, in Ireland, to the basalt; *Erica vagans* marks, in Cornwall, the course of many metalliferous veins; and the prevalence of other species on sandy, clayey, chalky, or calcareous beds is well known.

Great Britain presents in its rock-groups an epitome of the geological structure of Europe, if not of the known world, and offers, accordingly, material for the most fruitful and interesting study. Nowhere can better be seen the connection between geological influences and mining,

Hosted by Google

manufacturing, or agricultural industry. At the first glance, a map of England shows that west of a line drawn from the mouth of the Tees on the north-east, to Lyme Regis on the south-west, the chief occupations are mining and manufactures, while east of the same line agriculture is the staple. The people of the north, too, are distinct from those of the south.

The intelligent reader will naturally inquire into the causes of these phenomena. We will at once direct attention to them, and offer some general remarks on the geological distribution of the minerals most useful to man.

GENERAL PHYSICAL GEOGRAPHY OF ENGLAND AS DEFENDENT ON ITS GEOLOGY.

The rocks of Great Britain are divided, according to the origin of their present condition, into two great classes and one sub-class—viz., *aqueous* rocks, formed by the action of water; *igneous* rocks, formed by the action of fire; and *metamorphic* rocks, which, originally stratified or aqueous, have since been changed in their texture by igneous action.

Igneous and metamorphic rocks comprise only a small proportion of the rocks of England and Wales. In North Wales they appear largely in the counties of Merioneth, Caernarvon, and Anglesea; and for twenty miles eastward of St. David's Head igneous rocks are variously distributed. Rocks of these groups constitute the Grampians, the South Highlands of Scotland, the Cheviots, and the Malverns; they occur too in Derbyshire, Worcestershire, Charnwood Forest, Devon, and Cornwall, whilst the midland, southern, and eastern parts of England are devoid of them.

Aqueous rocks, constituting by far the greater proportion of the rocks of the entire world, form in our island a number of beds arranged in succession one upon the other, each set of beds, or *formations*, presenting peculiarities which enable the geologist to recognise and place them in a serial

Hosted by Google

order, which order is irreversible. The following table exhibits the series of formations composing the stratified rocks of England :—

Epochs or Periods.	*Systems.*	*Formations.*
TERTIARY or CAINOZOIC.	*Pliocene*	Post-Pliocene. Newer Pliocene. Older Pliocene.
	Miocene.	———
	Eocene	Upper Eocene. Middle Eocene. Lower Eocene.
SECONDARY or MESOZOIC.	*Cretaceous*	Chalk. Upper Greensand. Gault. Neocomian. Wealden.
	Jurassic	Purbeck. Portlandian. Kimmeridge Clay. Coral Rag. Oxford Clay. Cornbrash. Great Oolite. Inferior Oolite. Lias.
	Triassic or New Red Sandstone ...	Keuper. Muschelkalk (absent in England). Bunter.
PRIMARY or PALÆOZOIC.	*Permian.*	———
	Carboniferous ...	Coal Measures. Millstone Grit. Mountain Limestone.
	Devonian and Old Red Sandstone.	———
	Silurian	Upper Silurian. Middle Silurian. Lower Silurian. Primordial Silurian.
	Cambrian.	———
	Laurentian.	———

In the west, in Devon, Cornwall, and in Wales; in the north-west, in Cumberland; and in the Pennine chain, which stretches from Northumberland to Derbyshire, we

Hosted by Google

have the chief mountainous and hilly tracts of England and Wales; all of which are composed of palæozoic rocks, elevated by the disturbances to which they have been subjected.

If we pass from the older rocks of South Wales and the border counties in an easterly direction, as from the neighbourhood of Gloucester to London, to the newer and less disturbed rocks, we find that they present low undulating grounds and plains of New Red Sandstone and Lias, succeeded by two great escarpments, the edges of table-lands, of not more than 1,000 feet above the sea, sloping toward the east. The western escarpment, as seen in the Cotswold Hills, is formed by the Oolitic, and the eastern by the Cretaceous or chalk strata; the Tertiary, comprising on the east the London, and on the south the Hampshire basins, overlie the chalk.

This physical structure of England is represented in the following generalised section:—

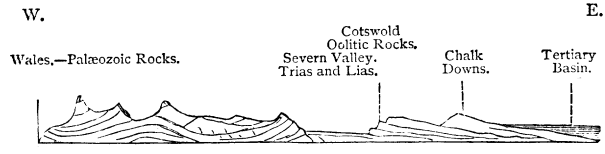


Fig. 1.

If we examine the country farther north, say from Snowdon to Flamborough Head, the arrangement of strata will be found very similar to that observed in the line of the southern section. Thus, in the west rise the disturbed palæozoic strata which form the mountain region of North Wales; in Flint and Denbigh Carboniferous rocks appear; then in Cheshire lies the great plain of New Red Sandstone, from underneath which rise, in Derbyshire, the Carboniferous strata, forming the high grounds in that county; these are succeeded by the low escarpment of the magnesian limestone of the Permian system; and then come plains of New

Hosted by Google

Red Sandstone again, crowned by the escarpment of the narrow strip of Oolite, and by that of the Cretaceous rocks.

This structure explains the course of the larger rivers. The principal watershed of the country is the tract of high ground extending from the north of Scotland far into England; it is nearer to the west coast than to the east, and therefore a much larger area of country is drained towards the east than towards the west. All the larger rivers—with the exception of the Severn and its tributaries—run into the German Ocean. The plains, which occupy much of the middle and east of England, are traversed by many tidal rivers, and from the nature of the country the construction of canals has been a comparatively easy task.

GEOLOGICAL DISTRIBUTION OF MINERAL PRODUCTS.

The modes of occurrence of minerals are in veins or lodes, in regular or irregular beds, and in connection with *detrital* matters. The consideration of the distribution of minerals will be treated of under these heads.

I. Minerals in Veins.

Though it is difficult, in the present state of our knowledge, to ascertain the laws regulating the deposit of metalliferous matter, yet we are able, from general observation of the geological structure of the earth, to say that *here* search may be made for minerals with some hope of success, and that *there* exploration will be futile. Hundreds of thousands of pounds have been expended in the opening up of mineral districts, a large proportion of the sum utterly without profit.

Great Britain possesses a rich supply of minerals; we have gold, silver, copper, lead, tin, zinc, antimony, nickel, cobalt, bismuth, uranium, chromium, and other of the rare metals, besides vast stores of iron; our coal beds are enormous; and earthy minerals are in great variety and value. Statistics show that in great Britain 350,000 persons

Hosted by Google

are actually engaged in mining operations, exclusive of quarries of all kinds, and that the produce is of the minimum annual value of £40,000,000.

The lodes from which we derive our chief supply of metals are almost wholly confined to palæozoic rocks. Their occurrence may be sketched as follows :—

The Silurian formation in North Wales, in the Isle of Man, in Cumberland, in the Lead Hills of the south of Scotland, in parts of the Highlands, and in parts of Ireland, contains metalliferous veins which yield gold, ores of copper, lead, silver, antimony, arsenic, and zinc.

The rocks of the Devonian formation in Devon and Cornwall contain rich tin, copper, and lead lodes.

The Carboniferous Limestone in Derbyshire, ranging up to the north of England through Cumberland and the adjacent counties, also of the Mendips, and in Devon, is the chief depository of our lead ores. The same formation contains large and rich deposits of hæmatite, an ore of iron, as in the Forest of Dean, Somersetshire, Cumberland, &c.

Throughout the world, all the metalliferous lodes, with some peculiar exceptions hereafter to be mentioned, occur in stratified or the associated igneous rocks, not newer than the Permian. It is thus that one generalisation in the inquiry is arrived at, viz., that of the *period* during which the lodes carrying our richer metals were filled. Geology, like the more exact sciences, is capable of advancing philosophical inductions to very important results. Sir Roderick Murchison was enabled in 1844, from the study of the gold-bearing tracts in Russia, to predict the discovery of gold in Australia. "Having," writes Sir R. Murchison, "in the year 1844, recently returned from the auriferous Ural Mountains, I had the advantage of examining the numerous specimens collected by Count Strzelecki, along the eastern chain of Australia. Seeing the great similarity of the rocks of those two distant countries, I could have little difficulty in draw-

Hosted by Google

ing a parallel between them; in doing which, I was naturally struck by the circumstance that no gold 'had *yet* been found' in the Australian ridge, which I termed in anticipation the 'Cordillera.' Impressed with the conviction that gold would, sooner or later, be found in the great British colony, I learned in 1846 that a specimen of the ore had been discovered. I thereupon encouraged the unemployed miners of Cornwall to emigrate and dig for gold, as they dug for tin in the gravel of their own district. These notices were, as far as I know, the first published documents relating to Australian gold." ("Siluria.")

Mineral veins occur in igneous as well as in aqueous rocks; but the intrusion of an igneous mass among stratified deposits appears to have rendered their lodes richer than elsewhere, amid conditions in other respects similar.

Gold is usually found in a quartz matrix, traversing palæozoic shales, chiefly those of the Lower Silurian epoch; and the auriferous lodes are frequently richest in the vicinity of eruptive rocks. But the precious metal is found also in secondary rocks, such as those of California, Peru, Bolivia, &c., yet under circumstances exceptional to the *usual mode of association of gold.* It appears that where certain igneous eruptions, of diorite especially, have penetrated the secondary strata, the latter have been rendered auriferous for a limited distance only beyond the junction of the two rocks; and it is concluded that all secondary and tertiary deposits (except the auriferous detritus of the latter) not so specially affected never contain gold.

The lodes carrying copper and tin in Cornwall and Devon are richest about the junction of the *killas* (local name for the slaty rocks of the Devonian formation in this district), and the bosses of granite, and where they are intersected by granitic dykes, termed *elvans.* It is worthy of remark that these metalliferous veins have a course or strike nearly east and west, and that these phenomena are not

Hosted by Google

confined to this area, but are exhibited in Saxony and elsewhere.

Other examples might be adduced, but these will suffice to show that *intrusive rocks influence the metalliferous richness of veins.*

II. Bedded Mineral Deposits.

These include coal and iron ore, of primary importance; and salt, gypsum, cement-stones, coprolites, iron-pyrites, bituminous shales, &c., of secondary value.

(*a.*) *Coal* occurs in many formations; it has been mined for upwards of a hundred years at Brora, in Sutherlandshire, in rocks of the Oolitic epoch, and is worked at Bovey Tracey, Devonshire, in Miocene beds. An anthracite occurs in the Devonian rocks in Spain; there are good workable coals of the age of the Trias in Virginia and Hindostan, and of that of the Lias in Hungary; and less valuable coals, chiefly brown coals, occur in Tertiary strata in Austria and other parts of Germany. But by far the richest and largest supplies are drawn from the Carboniferous system in Great Britain, Belgium, United States, Nova Scotia, Australia, &c.

In Great Britain no coal is found below the Carboniferous strata, but it does occur in newer strata. In the midland and south-western counties of England, and in South Wales, it is confined to the true Coal Measures underlain by the Millstone Grit, locally called the "farewell rock," because, in the language of the miner, when that rock is reached, one bids farewell to the coal. But in the north of England and in Scotland workable coal seams occur in the inferior formations of the Carboniferous system, as well as in the Coal Measures.

A correct knowledge of the law of superposition of rocks in relation to our coal-bearing strata, is of value not only to the man of science, but to every speculator in mines, and to every landed proprietor who cares to understand the mineral value of his property. Not long ago, considerable

Hosted by Google

funds were spent at Tullygirvan, Co. Down, in a useless search for coal. The adventurer had set to work in black Silurian shales, their mineral aspect resembling that of certain coaly strata, with which he was, perhaps, familiar; but had he possessed even a slight acquaintance with organic remains, he would have abandoned his experiment at the commencement, for the shales were charged with graptolites. Now the scientific miner knows that rocks containing graptolites, trilobites, &c., existed untold ages before the epoch of the coal strata; so that when he meets with those remains, he concludes that money spent in search of coal beneath them will be turned into irredeemable dust, for they occupy, in the irreversible order of deposits, a position thousands of feet beneath the Coal Measures.

Lord Londonderry bored in the Old Red Sandstone, at Mount Stewart, Co. Down, in search of coal; here, though no fossils occurred, yet the position of the sandstone strata above the previously mentioned Silurian shales, and overlain as they are by Mountain Limestone, proved the impossibility of coal being found.

In the neighbourhood of Carrickfergus are two silent witnesses of the folly of sinking for coal where the geological structure of the country precludes the possibility of its presence, or of its occurrence at reasonable depths. Trial shafts had been sunk in New Red Sandstone, which was pierced to a depth of about 1,000 feet, when the adventures were abandoned. Before coal could be reached, the Permian strata would have to be passed through; and from the unconformability of the New Red Sandstone to the Permian, and of that set of strata to underlying formations in this district, it was even doubtful if coal could be reached at all.

But coal has been successfully reached by the penetration of newer unconformable strata; thus, in the Somersetshire coal-field, the coal shafts pass through New Red Sandstone,

Hosted by Google

the Permian strata being absent. The famous Monkwearmouth pit passes through 330 feet of overlying Permian rocks.

In these and other instances that might be adduced, the undertakings had been commenced at the suggestions of those who were perfectly satisfied, from an examination of the surrounding country, of the feasibility of the venture. Yet, on the other hand, attempts have been made to reach coal from below secondary rocks, when, with but a broad knowledge of the geological structure of the country, the trials should have been at the outset abandoned. Thus, at Kingsthorpe, near Northampton, a shaft was sunk through the Lower Oolite and Lias, at an expenditure of nearly £30,000; the adventurers desisted when they reached the New Red Sandstone. A similar trial took place near Lyme Regis, the Lias being bored for coal at an expense of several thousand pounds; the deception was fostered by the accident of passing through a *piece* of lignite.

(*b.*) *Iron Ores.*—Certain ores of Iron occur in lodes in primary strata, but others, especially the spathic and brown hæmatite ores, are intercalated as bands among shales and limestones of the Carboniferous, Liassic, Oolitic, Wealden, and Cretaceous strata; but by far the largest supply is obtained from the Carboniferous system, the same shaft often communicating with both coal and ironstone workings, and the same group of rocks furnishing limestone.

The Carboniferous system contains our greatest sources of natural wealth. It yields the coal which gladdens our hearths and heats our roaring furnaces. It supplies us with iron ores and lime, and with the fuel necessary for smelting the iron, for the most part in close proximity to the ores. We have thus two conditions especially favourable to the production of cheap iron—abundant ore and fuel—occurring together. In no other country perhaps, save Belgium, do we find an equally favourable combination of circumstances.

Hosted by Google

The absence from Ireland of any vast deposits of bituminous coal necessarily prevents the establishment in that country of those branches of industry in which the cost of fuel forms any very large proportion of the total cost of production. Hence, we have not had there any successful establishment of iron-smelting in recent times. The iron ores, however, both as earthy and bituminous carbonates and as hæmatites, are now largely exported from Ireland to England and Scotland to supply the enormously increasing demand.

Large quantities of copper and other ores raised in Ireland, Chili, Mexico, &c., are sent to Swansea to be smelted, as the proportion of fuel which is required would render the process in those countries too costly to be profitable. In other words, it is cheaper to carry ore to the coal, than coal to the ore. Similarly the various clays raised in the south of England are transported to Staffordshire to be converted into useful articles.

Previous to the employment of steam as a motive force, water was the prime mover; consequently our manufactories, at that time, were located where water-power was at command. But on the application of coal to the generation of steam, the seats of manufacturing industry were necessarily transported to the districts where this mineral could be obtained abundantly and cheaply. Norwich, York, and Spitalfields could then no longer compete with the towns more favourably circumstanced, and in course of time ceased to be the great manufacturing centres. Lancashire, on the introduction of steam machinery, soon became the greatest manufacturing district, owing to its situation with respect to our coal-fields and to our outlets of commercial industry.

From the time of the Romans to the seventeenth century the Weald of Kent and Sussex was one of the chief sites for the production of iron, because of the close proximity of the fuel, wood, to the ore; but when coal

Hosted by Google

came to be used in the reduction of the ores, this branch of industry declined, and was soon removed to districts where the more abundant and cheaper supply of fuel was to be found.

From the foregoing remarks we have an explanation why the coal-producing counties are the centres of our manufacturing industry.

(*c.*) *Other bedded mineral products* are met with in strata of various ages. Slates are quarried in Silurian rocks in Caernarvon and Merioneth, in Cumberland, and in some parts of Scotland. In these districts there is a very large population supported entirely by the quarrying and preparing of slates.

Rock salt is confined in Great Britain to the Keuper sandstone and marls.

(*d.*) *Building and architectural stones* are chiefly quarried in the Devonian, Carboniferous, Permian, and Oolitic strata.

The mining of *Iron Pyrites* is a large branch of industry in Ireland, and the basis of an extensive series of chemical manufactures in which the cost of fuel does not form a preponderating item. This mineral is collected in Scotland, the north-eastern parts of England, &c., being derived from the Carboniferous and the newer formations.

(*e.*) *Coprolites*, the excreta of extinct gigantic reptiles, and *pseudo-coprolites*, the osseous remains of large vertebrates, and nodular concretions of phosphate of lime of organic origin, cannot be expected to occur in strata of an epoch anterior to that in which those animals lived. They occur in the Liassic, Neocomian, and Cretaceous strata, and in the newer Tertiaries, these last formations being characterised by the remains of whales and other mammals, as the first are by *ichthyosauri*, *plesiosauri*, and other huge reptiles. As a source of manure, coprolites have become important.

Hosted by Google

III. Detrital.

The chief minerals found in detrital deposits are gold and tin-stone, *i.e.*, stream-tin. Being derivative, the occurrence of these minerals indicates the existence of rocks containing them, either in the immediate neighbourhood, or in tracts drained by a local stream or its tributaries.

Keeping in view the geographical distribution of the palæozoic rocks, especially of the Silurian, Devonian, and Carboniferous systems, and the fact of these strata being the sources of our chief mineral wealth, let us now apply these phenomena to the industrial pursuits of the people of these areas.

RELATION OF GEOLOGY TO AGRICULTURE.

I. Botanical Aspect presented by Geological Formations.

It has been stated that the soils of a country vary to a great extent with the nature of the underlying geological formations. This phenomenon may be best illustrated by reference to the district in the line of section shown in Fig. 1. (See page 23.)

The western parts of Wales, where the land attains an elevation of from 2,000 to 4,000 feet above the sea-level, are covered with heath, and are only fit for inferior pasture lands. Monmouthshire, Brecknockshire, Hereford, and parts of Worcestershire are occupied by the rocks of the Old Red Sandstone formation; and in consequence of their susceptibility of decomposition, the marls breaking up into rich earth fitted for tillage, they naturally form a more fertile soil than that derived from the slates of the west; hence we have in the former districts good corn lands and productive orchards.

The low plain of New Red Sandstone presents facilities for agriculture similar to those of the Old Red Sandstone tract.

The configuration of the surface of the country occupied by the Jurassic rocks which succeed, may be viewed as an

Hosted by Google

alternation of clays and limestones. The outcrops of the clays can actually be traced by the wide valleys, which are permanent grass lands; whilst the limestones compose ranges of low hills or more elevated grounds. These limestone ridges form escarpments (see Fig. 1) along the line of strike, that is, on the sides (N.W.) on which the several clays rise up from beneath the calcareous beds. The soil on these limestones is well adapted for the growth of cereals, turnips, and clovers.

Passing on to the Cretaceous series, which in the south forms extensive tracts, we meet with silicious, argillaceous, and calcareous soils. The rocks in the western part of the Wealden area contain little lime and much silica, and are covered by some very wide-spread heaths not worth bringing into cultivation. The natural forest-lands of the Weald or Wold are on the Wealden Clay, which has been cultivated, though only of late years, by the help of deep drainage.

The base of the chalk escarpment is usually marked by a stratum of clay—the Gault—which thus occupies a valley, and is a pasture tract. But the chalk strata which form the South Downs and stretch far to the west, into the centre of England, and thence away to the north-east, are chiefly used for the purpose of sheep-pasturage. There is little or no soil upon them, the herbage is short, and trees are absent; however, the chalk ranges, especially the broad, sweeping plain of Wiltshire and Hampshire, are gradually coming under tillage—the chief crops being grain, turnips, clover, and sainfoin.

The soils derived from the decomposition of rocks containing magnesia—such as the dolomite of the Permian, which ranges from Nottingham, through Derbyshire and Yorkshire, to Tynemouth, and the serpentines of Cornwall —are rich, but perhaps less so than those derived from ordinary calcareous strata. The Lizard Downs are, however, reckoned fine pasture-land, the cultivated parts are

Hosted by Google

amongst the best corn-lands in the county; and agriculturists agree that the land on the Permian tracts is extremely fertile.

The Tertiary beds of the basin of the Thames are for the most part cultivated tracts, excepting where the Bagshot Sands form the superficial stratum. These are familiar to us as heathy wastes, such as Aldershot Heath, Bagshot Heath, Hampstead Heath, and have been converted into camping and exercise grounds for our troops and volunteers.

The older palæozoic rocks, although rich in minerals, are generally barren, and seem peculiarly dreary and desolate. This arises partly from the nature of the strata, and partly from the circumstance that, occupying hilly regions, they are to a great extent above the limits of the growth of economic plants, even if within the reach of ordinary agricultural operations.

The Highlands of Scotland, composed of masses of gneiss and granite, are heathy and barren, since their hard rocky materials come almost everywhere bare to the surface, forming a wild pastoral country, browsed by black cattle, poor sheep, and red deer. The neighbourhood of Parys Mountain, in Anglesea, is singularly marked by sterility and gloominess—there is neither shrub nor tree, and the barrenness is unrelieved even by a single blade of grass. Other examples might be adduced in illustration of the unproductive nature of the soil of the oldest palæozoic and metamorphic rocks. But in all these regions the character of the surface will be more or less modified by the occurrence of *alluvial* deposits bordering the rivers, and by the presence of a glacial drift—the effect of denudation upon various rocks, producing a favourable mixture of clay, sand, and lime, which forms a rich soil.

II. Influence of certain Constituents of Rocks on the Growth of Plants.

Rocks may be divided into three classes—siliceous, argillaceous, and calcareous. Siliceous rocks of soft

Hosted by Google

nature produce light soils, which are the least productive; whilst the hard, intractable grits form little soil, because they are difficult to decompose, and that little is to a great extent barren. The slaty rocks present the same superficial aspects as those of the hard grits; but the soft argillaceous soils, from their power of retaining water, are heavy, and are usually laid out into permanent pasture-lands. The pure calcareous strata, as chalk, though forming soils ranking amongst our richest, are not to be compared with those resulting from the disintegration of more mixed rocks.

(*a*) *Inorganic Constituents of Plants.*

A plant is compounded of two sets of constituents, the organic and inorganic; the former is derived from water and the atmosphere, whilst the latter is obtained from the soil. Now the quantity of inorganic food required by different vegetables is greater or less according to their nature; and if a soil be of such a kind that it can yield only a small quantity of this inorganic food, then those plants will only grow well upon it, for which this small supply will prove sufficient. Thus trees may grow where arable crops often fail to thrive, because many of the former require and contain comparatively little inorganic matter.

TABLE OF THE PROPORTION OF INORGANIC MATTER IN 1,000 POUNDS OF THE FOLLOWING SUBSTANCES.

	lbs.		lbs.		lbs.
Wheat, about ...	20	Oak Wood ...	2	Peas	50
Oats	40	Pine Wood	1½ to 3	Turnips	5 to 8
Barley	30	Wheat Straw ...	50	Ash Wood	1 to 6
Beans	3	Oat ,, ...	60	Elm Wood ...	19
Clover	90	Barley ,, ...	50	Elm Leaves ...	100

Meadow Hay, 50 to 100 lbs.

From the above table it appears that the quantity of inorganic matter varies in different parts of the same plants —as for example, the straw of our crops contains more ash than the grain. In trees and plants the leaves are richer in inorganic matter than the wood or stalk.

Hosted by Google

The quality of the ashes of plants varies with the same conditions by which its quantity is affected. The more commonly occurring mineral substances in them are—phosphates of lime, soda, potash, and magnesia; carbonates of soda and lime; chlorides of potassium and sodium; sulphates of soda and potash; iron and silica.*

TABLE OF THE QUANTITY OF INORGANIC MATTER IN VARIOUS SPECIES OF PLANTS.

	Wheat.	Barley.	Oats.	Rye.	Indian Corn.	Beans.	Linseed.	Potato.	Turnip.
Potash	237	136	262	220	325	336	245	557	419
Soda	91	81	—	116		106	34	19	51
Lime	28	26	60	49	14	58	147	20	136
Magnesia	120	75	100	103	162	80	99	53	53
Oxide of Iron ...	7	15	4	13	3	6	19	5	13
Phosphoric Acid ...	500	390	438	495	449	380	381	126	76
Sulphuric Acid ...	3	1	105	9	28	10	9	136	136
Silica	12	273	27	4	14	12	57	42	79
Chlorine	—	tr.	3	—	2	7	3	42	36
	998	997	999	1009	997	995	994	1000	99

We deduce from the foregoing table that a crop of wheat will extract from the soil certain ingredients, while beans and potatoes will extract others. Hence a piece of land may suit one kind of crop and not another. Hence, also, two successive crops of different kinds may grow well where it would greatly injure the soil to take two in succession of the same kind; and it is also evident that the cereals contain phosphates, and that there is much potash in potatoes and turnips; while beans and most leguminous plants contain lime.

* For analyses of the *ashes of* SEAWEEDS from the Scotch coast in 1852, by Dr. John Yeats, and their economic value, by Professor J. Anderson, see *Transactions of the Highland and Agricultural Society of Scotland*, No. 33, New Series, p. 448 *et seq.*

Hosted by Google

As the straw of cereal plants contains comparatively little of some of the ingredients found in the ear, such as lime, magnesia, and phosphoric acid—the straw and ash being especially rich in silica—so the roots may in certain plants and in certain soils succeed in fully nourishing the straw, while they cannot fructify the ear; or the very reverse of this may occur.

(*b.*) *Sources of the Inorganic Constituents of Plants and the Agricultural Capabilities of Soils derived from various Geological Epochs.*

As the inorganic compounds are derived from the soil or from manure supplied to it, the adaptation of certain crops to given land will be dependent upon the chemical composition of the rock from which the soil is derived. Soils derived from rocks devoid of phosphates cannot produce cereals, whilst soils produced from the decomposition of rocks that contain the inorganic constituents of cereals are necessarily the best adapted for the growth of such crops.

Dr. Daubeny experimented upon the relative amount of phosphoric acid obtained from barley sown in pulverised samples of various strata of different geological epochs, and he found that whatever the age of the rock might be, provided it belonged to a series in which organic remains were present, phosphoric acid was one of the constituents of the rock. On the other hand, phosphoric acid was absent in certain slates which lie below the oldest rocks in which organic remains have been detected—such, for instance, as those of Nant Francon, Llanberis, near Bangor, to the north of Dolgelly; schist taken from the foot of Snowdon; mica-schist from Loch Lomond; and certain specimens from the Longmynd Mountains.

The reclamation of those great tracts of land, the peat-bogs in Ireland, for the purposes of agriculture, has occupied a very large amount of attention; but the progress of chemistry in later years has divested the question of much of the paramount importance that was formerly attached to

Hosted by Google

it; for now that by the researches of Liebig and others the true principles of the growth of agricultural crops are understood, it is well known that, even if thoroughly drained, peat will not supply the materials necessary for the production of food, and that the cost of introducing those materials in the form of manures, if applied to land in better condition occupying the same area, will yield greater and more profitable returns.

An examination of the chemical components of the following rocks, the soils of which form our finest corn-growing lands, will show the practical advantage of geological and chemical knowledge, and explain the great difference in the respective producing powers of such soils :—

	Inferior Oolite.	Great Oolite.	Cornbrash.
Carbonate of Lime... ...	89·20	95·346	89·195
Magnesia	·34	·739	·771
Sulphate of Lime	·09	·204	·241
Alumina	4·14	1·422	2·978
Phosphoric Acid	·06	·124	·177
Soluble Silica	2·75	1·016	1·231
Insoluble Silica	3·27	·533	4·827
	99·85	99·384	99·420

These analyses show that phosphoric acid and sulphate of lime—two important chemical substances in the growth of crops—greatly predominate in the Cornbrash, and are in excess in the Great Oolite above the Inferior Oolite. The yield of corn, in bushels, of a fair average crop grown upon an acre, will be seen to be proportionate to the amount of these chemical substances in the soil; the one containing the largest amount of these salts affording regularly the largest crop :—

	Infer. Oolite.	Great Oolite.	Cornbrash.
Wheat (bushels)	15 to 20	20 to 25	25 to 30
Barley ,, ...	25 ,, 30	30 ,, 35	40 ,, 45
Oats ,, ...	25 ,, 30	35 ,, 40	45 ,, 50

Hosted by Google

The average of rent, which may be gathered from the following table, varies in accordance :—

Inferior Oolite ...	...	...	7s. to 20s. the acre.
Great Oolite ...	...	...	14s. ,, 25s. ,,
Cornbrash ...	...	...	20s. ,, 40s. ,,

III. Comparison between other Countries and parts of Great Britain.

With a geological map before him, the reader will now be able to infer from the physical features presented by any country the industrial pursuits of the people occupying it. We present a few examples :—

Since the rocks of *Normandy* and *Picardy* are identical with those of our midland and southern counties—being of Oolitic and Cretaceous age—we should infer that the inhabitants are agricultural, the chalk tracts being occupied by pasturage, the limestone of the Oolitic strata forming arable soils, whilst on its clays are grown a variety of crops.

Belgium is an equivalent to South Wales, or to the Staffordshire district, its four southern provinces being constituted of rock of the carboniferous age, and presenting an association of coal, iron, and limestone, such as we have ascertained to prevail in the English areas now mentioned. The aggregate of all mining and metal industries recorded for 1860 was £10,751,000; the principal products of its mines are iron-ore, blende, calamine, galena, and coal.

Switzerland the mountain country *par excellence* of Europe, with its metamorphic rocks, might be inferred to present a repetition of the phenomena which obtain in North Wales; but it is otherwise, for these granitic and gneissic rocks are but metamorphosed oolitic and newer strata; and as we have shown that deposits of these formations are usually unproductive in minerals, Switzerland, if our generalisations are correct, can never be a mining country, and, from its mountainous character, it can only be a pastoral one.

Saxony presents, in its rock masses and its mineral wealth, similar conditions to those which prevail in Devon and Cornwall.

Hosted by Google

Norway, from an agricultural point of view, is to Northern Europe what the Highlands of Scotland are to Great Britain; its rocks, however, contain some of the richest deposits of iron ore in the world.

GENERAL SUMMARY OF THE MINERALS RAISED AND METALS PRODUCED IN GREAT BRITAIN AND IRELAND IN 1867, EXTRACTED FROM THE "MINING RECORDS."

Minerals.	Quantities.	Value.
	Tons.	£
Coal	104,500,480	26,125,145
Iron Ore	10,021,058	3,210,098
Tin Ore	13,649	694,734
Copper Ore	158,544	699,693
Lead Ore	93,432	1,158,066
Zinc Ore	13,489	41,340
Iron Pyrites	116,889	67,453
Gold Quartz	3,241	5,320
Nickel Ore	2	14
Arsenic (*partly estimated*)	2,255	4,112
Gossans, etc.	5,482	5,808
Wolfram	10	62
Manganese	808	3,232
Barytes	11,107	7,807
Coprolites	37,000	70,300
Salt	1,394,939	836,963
Clays, *fine* and *fire*	1,179,300	589,650
Earthy Minerals not returned (*estimated*)	—	650,000
Total Value of the Minerals produced in the United Kingdom		£34,169,797

METALS OBTAINED FROM THE ABOVE ORES.

Metals.	Quantities.	Value.
	Tons.	£
Iron	4,761,023	11,902,557
Tin	8,700	799,203
Copper	10,233	831,761
Lead	68,440	1,337,509
Zinc	3,750	79,693
	Ounces.	
Silver	805,394	215,400
Gold	1,520	5,890
Value of other Metals (*estimated*) ...	—	15,000
Total Value of Metals	—	£15,187,013

Hosted by Google

ABSOLUTE TOTAL VALUE OF THE METALS AND COAL AND OTHER MINERALS PRODUCED IN 1867.

Value of the Metals produced from the Mines of the United Kingdom	15,137,013
Value of Coal	26,125,145
Other Minerals, not smelted, Salt, Clay, etc. ...	2,167,934
	£43,430,092

GENERAL SUMMARY OF COAL EXPORTED FROM THE UNITED KINGDOM IN 1867, DISTINGUISHING THE COAL-FIELDS FROM WHICH EXPORTED AND THE COUNTRIES TO WHICH SENT AS COMPARED WITH THE TOTAL EXPORTS FOR 1866.

COUNTRIES.	Northern Ports.	York-shire.	Lanca-shire.	Western.	Scotch.	Shipped from London.	Total 1867.	Total 1866.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
France ...	920,477	81,900	30,310	848,927	67,243	626	1,949,483	1,898,125
Denmark...	432,278	55,438	116	42,563	82,828	1,236	614,451	618,206
Norway ...	103,704	17,913	—	4,776	70,918	—	197,311	166,884
Sweden ...	219,453	21,336	—	2,010	15,440	270	258,509	253,026
Russia ...	388,851	45,981	6,942	55,506	45,500	1,220	544,000	520,014
Austria ..	41,971	104	9,406	26,610	3,626	1,300	83,017	76,102
Germany...	687,261	30,358	—	34,338	39,954	—	791,906	724,121
Prussia ...	323,219	40,133	—	14,434	54,124	4,024	435,934	430,015
Holland ...	248,137	5,572	146	2,467	4,205	—	260,527	235,284
Belgium ...	129,667	16,563	900	2,742	5,716	—	155,588	64,843
Spain ...	124,249	16,710	20,918	211,033	8,451	220	381,581	424,433
Portugal ...	68,750	2,309	7,743	45,359	12,742	1,115	138,018	147,147
Italy... ...	188,657	9,762	14,163	158,920	47,358	—	418,860	521,760
Mediter'n	77,209	2,437	27,768	242,886	15,536	—	365,836	389,021
Greece ...	8,614	328	5,197	22,063	2,138	150	38,490	29,642
Turkey ...	85,308	4,723	6,071	137,408	7,878	2,920	244,308	234,565
Africa ...	235,411	6,717	15,444	244,680	15,290	5,540	523,082	408,788
Australia...	2,667	120	2,444	1,656	50	1,578	8,515	18,356
E. Indies...	287,625	5,148	317,061	290,422	59,557	30,473	990,286	660,086
W. Indies...	40,768	2,998	53,791	249,512	76,880	5,349	429,298	438,193
N. America	77,369	8,756	65,398	68,093	56,349	1,211	277,176	312,272
S. America	51,474	2,507	92,689	324,453	55,824	8,960	535,907	687,446
ISLANDS:—								
Channel ..	62,363	1,467	1,397	5,785	1,936	—	72,948	67,748
Heligoland	—	—	—	—	—	—	—	128
Iceland ...	928	—	235	190	1,377	—	2,730	1,595
Azores ...	618	373	445	3,747	135	493	5,811	2,931
Canaries ...	241	—	—	6,823	—	842	7,906	11,317
Madeira ...	4,085	—	—	—	12,028	733	16,846	11,054
Ascension	1,253	—	—	5,491	—	—	6,744	4,747
St. Helena	1,036	—	—	—	—	719	1,755	811
Falkland ...	—	—	—	645	—	70	715	2,491
N. Zealand	—	—	—	—	2,720	1,249	3,969	6,615
Sandwich...	150	—	120	—	—	50	320	35
Society ...	—	—	—	—	—	—	—	80
Totals ...	4,813,793	379,640	678,704	3,053,539	765,803	70,348	9,761,827	9,367,331

Hosted by Google

CHAPTER IV.

THE UNITED KINGDOM: IRELAND—RAW PRODUCE, MINERAL, ANIMAL, VEGETABLE.

Relation between Raw Produce and Industry—Geological Conditions of Mineral Produce—Application of Principles to Ireland—Ireland not noted for Minerals—Pre-eminently Pastoral—Vegetable Produce—Natural Advantages of Ireland—European Analogues.

THE industrial occupations of the people of the United Kingdom have been proved in the preceding pages to be the result of natural laws, and not of chance. The seats of mining and of manufactures are determined by the local mineral deposits, and the importance of the one is proportionate to the richness of the other—especially so in relation to iron and coal. Given the geological character of the rocks and soil, with the physical distinctions of highland, lowland, plain, and marsh, and the climatic phenomena, we may infer much of the raw produce, organic and inorganic.

The mountain borders of Ireland give occupation to labourers in mines and quarries, and copper and lead are produced in the counties of Wicklow, Cork, and Waterford. Iron is more widely dispersed, but for want of coal is unprofitable to smelt. Peat is almost the only fuel. Limestone is the principal rock of the interior; statuary marble of fine quality is met with in Galway, Kilkenny, and Donegal, and granite in many parts. Nevertheless, Ireland is not noted for useful minerals. The special physical feature is the dreary expanse of bog, occupying 3,000,000 acres, or a tenth of the central plain of the kingdom. The great bog of Allen, once a forest, spreads through four counties. These bogs are considerably above the level of the sea, and sometimes of

Hosted by Google

considerable thickness. They lie upon vast deposits of clay and drift, which overspread the Mountain Limestone, and, in steep impervious embankments, form the confines of stagnant reservoirs of saturated vegetable soil, unsafe in places for the smallest quadruped to walk upon. The structure of the bogs indicates the proper method of drainage, but notwithstanding a river system unusually complete, little has been reclaimed; and, since bog earth is deficient in mineral constituents, it is doubtful if drainage would ever repay, in produce, the cost of reclamation. Ireland is pastoral, and there appears no limit to its dairy and grazing capabilities. Pastures cover two-thirds of the country, and four-fifths of the people depend upon field labour. As a rule, however, the farming is inferior, the tillage slovenly, and the implements rude. The production of butter and provisions for export is, nevertheless, prodigious. Salt beef, pork, bacon, lard, and many millions of eggs, are consigned to England. Cork has, virtually, the victualling of our navy. Waterford despatches abroad over 100,000 casks of butter yearly, and slaughters every week an average of 5,000 swine, while the quays, a mile long, swarm with live stock for embarkation.

The eastern provinces are more flourishing than the western. The Curragh of Kildare competes with the English downs as a grazing-ground, and sheep have fed for ages upon its sweet herbage. In the open country corn intervenes between the breadths of potato, and meal and milk are used for food. The fields smile with the blue-flowered flax, which the cotters grow for their families and weave in the hand-loom. The people of these districts are of English or Scotch descent, and have carried their native skill and thrift into the country of their adoption. They command higher wages, and can pay higher rents for less propitious soil, than the native Erse.

Ireland's resources are, to a great extent, undeveloped. With a coast-line of 2,000 miles, and inlets penetrating the

Hosted by Google

land from opposite coasts, with a matchless system of rivers and lakes, the surface is a dissected map, every dividing line being a means of production or a facility for trade. The ill-fated Lord Strafford, more than 200 years ago, saw how well the flatness of the country and the slow flow of the rivers suited inland communication, and he devised a great scheme of intersecting canals even now but partially carried out.

Of recent years oats have come to be the crop most extensively grown, while the cultivation of wheat has so increased as sometimes to leave a surplus for exportation; nevertheless, the humidity of Ireland will ever render the harvests capricious. The native sheep was covered with a coarse hair, but by intermixture with English breeds is now improved. The production of wool is valuable and abundant, but the manufacture is confined to coarse goods, and carried on with insufficient capital. For cattle-rearing and dairy produce, Ireland might be matchless. Her only European rivals are Denmark* and the Netherlands, where the prevalence of water shrouds the plains with vapours, which clear away before the summer winds, to reveal meadows covered with kine. The quays and jetties of the Hanse Towns and the Dutch ports resemble those of Cork and Waterford, swarming with stock, and filled to repletion with cheese and "provisions." While Ireland has languished, however, and a fifth of her inhabitants has disappeared, Denmark and the Netherlands, with disadvantages from which Ireland has never suffered, have grown prosperous and opulent.

* "When the plains of Germany are brown and ashy with the summer heat, the isles of Denmark delight the eye with a fresh bright green, and as truly deserve the title of Emerald Isles as our sister kingdom. Vegetation is everywhere luxuriant, and long retains a vernal appearance, owing to the humidity of the atmosphere and of the soil."—*Milner's "Baltic,"* p. 82.

Hosted by Google

CHAPTER V.

THE UNITED KINGDOM: GREAT BRITAIN—RAW PRODUCE, MINERAL, VEGETABLE, ANIMAL.

General Description—Relation between Industrial and Geological Features—Mineral Produce of England and Scotland contrasted—British Mineral Produce compared with European—Animal and Vegetable Produce of Great Britain—Population.

ENGLAND is more a mining and manufacturing than an agricultural country, although the mineral region occupies but a third of the surface. The mining and manufacturing industries of Scotland assume larger proportions, with a still more confined space for their operation. The chief mineral products of Scotland, as of England, are coal and iron, the beds of which, together with limestone and sandstone, cover nearly a thousand square miles lying south of a line joining the estuaries of the Clyde and the Tay—the most populous, wealthiest, and busiest part of the kingdom. Rich mines of lead, with which a small quantity of silver is intermixed, are worked in the Lowther Hills. The Highlands are deficient in metals. The Grampians, especially, are as destitute of ores as their summits are of vegetation. The recent discoveries of gold in Sutherlandshire have up to the present not developed, to any extent, a new industry in this impoverished county.

The most important quarries of granite are those of Kirkcudbright, Peterhead, and Aberdeen. Whole towns in Scotland are granite-built, and with improvements in the machinery for cutting and preparing this stone, its use has greatly extended in England. Many of the new buildings which adorn London are decorated with polished shafts and columns of coloured granite. Its great weight prevents its

Hosted by Google

more general adoption for monumental and national designs.

Roofing-slates, also, are extensively quarried in a few parts of Scotland; and valuable building materials are supplied by the sandstones of the Old Red and Carboniferous systems.

Oolite is quarried in Gloucestershire, Somersetshire, and Portland. The city of Bath, St. Paul's Cathedral, Somerset House, and many London churches, show with what favour it is regarded for building. Lime is made from the chalk that stretches from the South Downs to Flambro' Head. Fuller's-earth is dug at Reigate; and millions of bricks, for railways, sewers, and buildings, are made from the London and other clays.

In the mining region, properly so called, we observe that Cornwall has scarcely any manufactures and very limited agriculture: its commerce and shipbuilding are comprised within the smallest bounds; but it has an apparently exhaustless supply of tin and copper, rendering this county one of great importance.

The South Wales coal-field is the parent of several industries. Besides the smelting of copper from Cornwall, and also from Ireland and abroad, and its production of fuel, it is a seat of the iron manufacture; Merthyr Tydvil and Cardiff being the most important towns thus engaged. Swansea is the centre of the copper-smelting. Our other coal-fields, with one exception, are also productive of iron-stone, and originate the characteristic pictures of the "Black Country" covering the Dudley coal-field, and of the congeries of iron-works, collieries, and factories which give to South Lancashire the aspect of one densely-populated town. The celebrated coal-field of Northumberland is deficient in iron-stone, although the neighbourhood of Hexham produces iron of very fine quality.

The wonderful supply of coal and iron casts every other mineral into the shade, else Great Britain would be called

Hosted by Google

rich in lead, zinc, and the minor metals. The precious metals are rare, and seldom worth the working. Burât has computed that the production of the useful metals and coal in Great Britain is four times that of France and Russia, six times that of Austria, eight times that of Spain or Scandinavia, nine times that of Prussia, and eleven times that of Belgium. What is the result? The metal and coal of Great Britain, transformed into machines, are computed to equal in productive power the hand-labour of every human being living. It is as if the population of a second world were contributing to lessen the toil of the thirty millions in this small corner of Europe. Manchester and Liverpool were small towns till machinery made our gigantic cotton industry possible. The imports of raw cotton have exceeded a thousand millions of pounds yearly, and are rapidly returning to that amount.

Eastward of a line drawn between the Tees and Exe, the surface exhibits fertile plains, varied by rivers, valleys, and green undulations, by a few wild and sterile heaths, and in the north by bogs. The Bedford Level and the Lincolnshire fens are the principal marshes. The soils, like the rocks upon which they lie, are not distinguished by their extent so much as by their variety. Clay, loam, sand, chalk, gravel, peat, are all represented, simply, and in many forms of combination, and impress distinctive characters upon an indefinite number of districts. The largest tracts of uniform soil are in Norfolk and the wealds of Kent and Sussex. Surrey has, for its size, more extensive tracts of sand and gravel than any other county, of which the heaths—Bagshot, Wimbledon, Weybridge, Woking—and the suburban commons of London are illustrations. Few of the plains are quite barren, and none of the sandy tracts are so large as the Landes of France. South of the wealds, from Beachy Head to Salisbury Plain, runs a low line of chalk downs, with a velvet pile of herbage, trodden and cropped by sheep of the finest breeds, famous both for flesh and wool.

Hosted by Google

Kent is the garden of England. The trailing hops of Canterbury and Farnham vie with the vineyards of France, and the hop-picking recalls the animation of the vintage. Between Sussex and the Wash, wide tracts wave with corn. Barley for malting is a great object of culture in the same tracts and in the midland counties, while oats grow chiefly in the fens and in the north. Potatoes thrive in Leicestershire and Cheshire, and the turnip tribe has spread from Norfolk all over the kingdom. Pulse grows everywhere. Flax and coarse hemp of excellent quality are cultivated, though the quantity is small.

The husbandry of Scotland ranks very high even within the mineral lines, but the soil capable of tillage is limited. Comparing one kingdom with another, England has half its surface in pasture, a third under tillage, and a sixth in wastes, towns, roads, and waterways; while Scotland has only one-fourth under cultivation, with three-fourths in wastes and ways. For the operations of husbandry a granitic district offers few facilities: the bare pinnacles weather slowly, and form too scanty a soil for cultivation. The Grampians are naked and sterile, as are also the broken islands of the north; while large counties, such as Sutherland, can only be laid out in sheep-walks. The most fertile parts of Scotland are the tracts between Perth and Dundee, Teviotdale, Fife, the Lothians, and Tweedside. From climatic causes the Scotch crops arrive at less perfection than they do in England; the solar heat is inconstant, and, as in Ireland, often insufficient to ripen grain and secure harvest. Barley of the same weight as English barley contains less sugar and does not malt well. Various fruits which ripen in the one division seldom mature in the other and never become so choice; but different berries acquire in Scotland somewhat of the delicious flavour which distinguishes them in still higher parallels of latitude.

Owing to the broken nature of the Welsh counties,

Hosted by Google

sheep and cattle are pastured upon the hills, which, unlike those of the Scottish highlands, are covered with grass to their summits, and tillage and dairy work are carried on in the valleys. Welsh sheep are small, but the mutton is renowned for the delicacy of its flavour.

In addition to food products, the special objects of British husbandry are barley and hops for beer, cider apples, and flax, but none assume the importance of the vine in France, or of flax in Holland.

ANIMAL PRODUCE: DOMESTIC ANIMALS OF GREAT BRITAIN.

Horses.—Hunting and racing are national sports. The English racer, improved with the best Arab blood, has become a type of the highest equine development. Yorkshire and Northamptonshire draught or dray horses, such as are used by the London brewers, are unrivalled in size and strength. The Suffolk Punch for ploughing, and the old Lincolnshire cart-horse, have long been eminent. The twelve sable steeds used to draw the state car at the funeral of the Duke of Wellington (in 1852) were a part of the trade stud of a distiller.

Cattle.—Our domestic cattle, like our horses, are among the finest in the world, although their number is insufficient to meet the home consumption. The Devonshire oxen, and the breeds of Gloucester, Hereford, and Sussex are as famous for muscular power as they are for fattening. Comely cows and finely-proportioned steers are the pride of English estates, and breeders compete for honour as well as for profit. The animals of the greatest bulk are those of Lincoln and Tweedside. The latter are of historical note, for during the long period of border warfare, the lifting of cattle, and the levying of black-mail were not merely incidents, but frequent incentives, of quarrel. In our days, Scotch kine are transported to the rich southern pastures to fatten for market. Dairy produce must not be undervalued,

Hosted by Google

for milk is consumed by young and old, and its secondary products, butter and cheese, enter more largely into the constituents of the food of every family than any substance except bread. The localities most favoured for dairy produce are referred to below.

Sheep.—Lincolnshire, Norfolk, Sussex, Wiltshire, and the Cheviots have given names to famous breeds of sheep, and, taking into account the fleece as well as the flesh, no foreign breed are their equals. By skilful crossing, the maximum of meat and wool of the best quality has been combined in the same animal.

Swine.—Berkshire, Gloucestershire, and Sussex have given names to breeds of pigs. The fame of Wiltshire bacon, York hams, and Berwick pork suggests a wide-spread attention to these animals. Indeed, any British farm would hardly be complete without a well-filled sty or hog-pen. Turned into the woods in autumn, swine will feed greedily upon acorns, beech mast, chestnuts, and other dry indehiscent fruit, without attacking and destroying the young trees.

Poultry.—Amongst the minor produce of the farm, poultry, headed by the common domestic fowl, stand highest. Turkeys and geese, at certain seasons, are fattened and brought to market in enormous numbers, providing us with an important supply of food.

Wild Animals.—The wild animals of Great Britain do not differ from those of Europe, and require but a brief reference. The bear, wolf, boar, fox, and wild ox once dwelt in the forests, and the beaver built on the river-banks. All but the fox and the ox have long since been extirpated. Wild oxen, unique types of our domestic breeds, are preserved with exclusive care in the spacious parks of Chartley, in Derbyshire, and Chillingham, the seat of Earl Tankerville, in Northumberland. They are smaller than the common ox, cream white in colour, with the exception of the ears, which are red, and the muzzle, which is black. Per-

Hosted by Google

mitted to range at will through spacious parks, they retain many of the wild habits of their race. The fox has received the doubtful privilege of being preserved for the chase. On the borders of Cornwall, a few stags are still found in their natural state, and more exist in the mountains and the wooded parts of Scotland, especially in the forest of Athol. The roebuck, which seeks the hills only, is also occasionally met with there. The fallow-deer of our parks are of foreign introduction, but have taken so well to the climate that the French imperial parks have been stocked from England. By a severe system of preserving (a relic of ancient forest laws), hares, partridges, and in the north, red grouse, continue abundant, despite the progress of agriculture and the extension of towns. Water-fowl frequent the fens, the most numerous being congeners of the wild duck, and sea-birds make the northern cliffs their home. The rivers of Britain contain fresh-water fish, the delight of anglers, but, with the exception of the salmon, little regarded as a source of food. The Welland and the Witham are at times so alive with the tiny stickleback, that farmers use them for manure.

VEGETABLE PRODUCE: FOOD SUBSTANCES FOR MAN AND ANIMALS.

Of the substances grown for the food of man, corn stands first; and of the different kinds, wheat is so pre-eminent in importance that the value of this crop nearly equals that of all the others. Reading, Guildford, and Uxbridge are the local markets for the finest white wheats, produced in the fertile fields forming the basin of the Thames; the south-eastern counties find their market for the same sort in London. The district between the estuaries of the Wash and the Thames is equally renowned for the growth of red wheat, a variety of inferior value but greater yield. Wheat does not ripen at the sea-level farther north than the line of lochs running from Loch Linnhe to the Moray

Hosted by Google

Firth. Next to corn, green vegetables form the chief supply of food for all classes, the great towns being surrounded on all sides with productive market-gardens.

Food crops for animals form an essential part of the industry of the husbandman, and consist of both grasses and roots. The grass, oats, and hay of England are of great excellence. A few weeks' feed in the alluvial marshes of the Thames restores imported foreign cattle from the effects of the roughest voyage, covers them with flesh, and fits them for the shambles. The root crops are either eaten down in the open field, or stored for winter food.

Fruits.—Of fruit-trees the species are not numerous, though the varieties of each species are endless. The apple is cultivated as a wholesome article of food, as a dessert fruit, and for cider. This fruit abounds in every part of the kingdom, but the Armorican region of the west and south-west of England is the cider district.

The pear stands next in value to the apple, flourishing under similar conditions of climate and soil, and furnishing a beverage called perry, chiefly made in Worcestershire.

Our orchards and gardens are enriched still further with drupes, or fruits of the almond tribe, as the plum, the apricot, and the cherry. The produce of the garden also includes gooseberries, currants, strawberries, and other small fruits, culinary vegetables, and sweet herbs. Some of these were brought from Holland in the reign of Henry VII. The indigenous fruits are very few and limited, probably, to the crab apple, the wild cherry, the bird cherry, the sloe, the haw, the bramble, the gooseberry, the cranberry, species of bilberry, and the raspberry.

Timber.—England has always been famed for her forests, which neither the enormous demand for ship and house building, nor the exigencies of improved farming, have yet caused to disappear. Most of the European exogens valued for their timber are found in England. The largest forests are Crown property, and still grow oak for the navy. Such

Hosted by Google

are the New Forest, covering 400 square miles; the Forest of Dean, in Gloucestershire, of 144 square miles, and others of smaller area. Many localities of historical note have long been disafforested, or thrown open to common use. Norwood and Charnwood, for example, are forests only in name. Science has lent the aid of iron as a partial substitute for wood, besides which we annually supplement our native stores by 4,000,000 loads of timber, 36 cwts. to the load, from British possessions and foreign parts.

The mountains and islands of Scotland are singularly treeless and bare. There are, however, a few extensive growths of fir, particularly in Aberdeenshire. The landed proprietors have of late years beautified their estates with larches, carrying out the behest of the Laird of Dumbiedikes, "Jock, when ye hae naething else to do, ye may be aye sticking in a tree; it will be growing, Jock, when ye are sleeping."

The chief kinds of British timber trees are the oak, the beech, the chestnut, the elm, and the ash. In the south, the elm, poplar, and birch are specially numerous. The ash and the Scotch fir are indigenous to the northernmost parts of the islands.

Great Britain contrasts with Ireland in the occupations of its inhabitants, a larger per centage being engaged in mining, manufactures, and commerce than in the varied pursuits of agriculture. Of the three divisions of Great Britain, only Wales shows a larger per centage of its population employed in agriculture than in other forms of industry; though here also the mineral counties are the wealthiest and most populous. To the end of the eighteenth century the people of England and Scotland were more engaged in agriculture than in mining and manufacture; but the development of mineral wealth has since been so great as to transpose the respective industries, and the tendency is, at the present time, still more rapidly in the same direction.

Hosted by Google

Agriculture advances absolutely, but relatively it retrogrades.

The subjoined tables will help to summarise and elucidate the details of the foregoing chapters :—

POPULATION OF THE UNITED KINGDOM, 1861.

	Great Britain.	*Ireland.*	*Total.*
England .	19,093,709		
Scotland .	3,062,294	5,764,543	29,032,341
Wales . .	1,111,795		

AVERAGE TO THE SQUARE MILE.

		Great Britain.	*Ireland.*
England . . .	302		
Scotland . . .	100	= 263	177
Wales	122		

DISTRIBUTION OF POPULATION ACCORDING TO OCCUPATIONS.

	Mining, Manufactures, Commerce.	*Agriculture.*
England . .	17 per cent.	7·7 per cent.
Scotland . .	18 ,,	8·8 ,,
Wales . . .	10 ,,	11·4 ,,

POPULATION ACCORDING TO COUNTIES.

DENSEST POPULATION.		LEAST POPULATION.	
ENGLAND.	*Manufacturing or Mining Counties.*		*Moorlands or Agricultural Counties.*
Middlesex .	7,822 to sq. mile.	Westmoreland .	80 to sq. mile.
Lancashire .	1,275 ,,	Cumberland .	131 ,,
West Riding of Yorkshire .	565 ,,	North Riding of Yorkshire .	135 ,,
Staffordshire .	656 ,,		
Cheshire .	457 ,,		
Durham .	523 ,,		
WALES.			
Glamorgan .	372 to sq. mile.	Merioneth .	64 to sq. mile.
Flint . .	242 ,,		
Anglesea .	180 ,,		

Of the cultivated land in England, 40 per cent. is arable, and 60 per cent. meadows, pastures, and marshes. In Wales 30 per cent. is under tillage, and 70 per cent. is in pasture.

Hosted by Google

DISTRICTS OF ARABLE HUSBANDRY.

ENGLAND.—Kent, Essex, Suffolk, Norfolk, Hampshire, Berkshire, Bedford, Surrey, Sussex, Hertford, parts of Yorkshire and Lincolnshire, Durham, and Northumberland.

SCOTLAND.—The Lothians, Berwick, and part of Roxburgh, Dumfries, Ayr, Renfrew, Lanark, and Fife shires, Carse of Gowrie, parts of Aberdeen, Elgin, and Nairn.

DISTRICTS OF DAIRY HUSBANDRY.

ENGLAND.—Cheshire, Shropshire, Gloucester, Wiltshire, Buckingham, Essex, York, Derby, Cambridge, Dorset, and Devon.

PASTORAL AND CATTLE REARING DISTRICTS.

Lincoln, Somerset, Leicester, Northampton, Herefordshire, parts of Durham and of the North and East Ridings of Yorkshire, and the Downs.

PER-CENTAGE OF INHABITANTS ENGAGED IN AGRICULTURE.

Lincolnshire, 16 per cent.; other districts as above, 10 per cent. to 14 per cent.; Middlesex, 1 per cent.

Hosted by Google

CHAPTER VI.

BRITISH FISHERIES.

Declining Condition of British Fisheries—Staple Fishery—Salmon Fishery—Shell Fish—Whale Fishery.

THE British seas are wonderfully rich in food-produce, and, from our inborn love of the ocean, flourishing fisheries might be predicated; but, relatively to the progress of other industry, these have been languidly pursued. It was once thought necessary to pay bounties upon the take, a false economy happily discontinued, and without diminishing the supply.

The staple fishery of the United Kingdom is that of herrings, shoals of which, at the season of spawning, crowd the inlets and bays of Great Britain and Ireland. Of the English fishing stations Yarmouth possesses the greatest celebrity for its semi-smoked and salted bloaters, everywhere esteemed. From Yarmouth to the Shetlands, fleets of herring-boats ply their nets, every town on the coast being more or less employed in the capture and curing of this important fish. The Scotch herrings are larger and higher-dried than those of Yarmouth. The chief fishing-station, probably, in the United Kingdom is Wick, within a few miles of John o' Groat's. Peterhead and Fraserburgh are likewise places of great resort for curing herrings. The Scottish fisheries generally are prosecuted with energy in every firth and loch, as well as in the channels of the northern and western islands. The Irish fisheries, on the other hand, have thriven least. Some of the most considerable are on the Nymph Bank, south of Waterford, but the produce is principally taken to English ports, while salted herrings are obtained from Scotland.

Hosted by Google

Pilchards, allied to the herring, are taken chiefly during September and October. They are found in all the creeks of Ireland, and off the coasts of Devon and Cornwall. These fisheries fall but little short of the importance of that of Yarmouth; yet while herrings are the frequent frugal meal of the London poor, pilchards are hardly known to them, and are only seen when a few stray catches are used as prize sprats to embellish the fishmongers' silvery heaps. Many thousand hogsheads of pilchards are exported to the Mediterranean, whence we get the closely-related anchovy and sardine, the interchange adding to the variety of food on both sides. Sprats are found in enormous shoals during the winter months, and are too often wasted for want of a ready market.

Between the Cornish and Yarmouth fishing-grounds mackerel intervene, extending mainly from the Isle of Wight to the Straits of Dover, and assuming during the season a very considerable value. From Ireland large supplies of remarkably fine mackerel have lately been received, packed in ice.

Turbot, soles, and other so-called flat fish, as well as cod, abound on the sandbanks of the North Sea, especially the central Great Dogger Bank. Here fishing-boats are now stationed for weeks together, and the produce of the nets is forwarded to London and elsewhere as fast as swift-sailing cutters or large screw steamers can carry it. By this means many additional hundreds of tons of fine fish, especially plaice and haddocks, are obtained for the poorer population of our large towns. There are extensive cod and white-fish fisheries in Scotland. The fishing-grounds round Ireland abound with cod, hake, and ling, but have never yet been satisfactorily worked.

The salmon originates a peculiar fishery, in which again the Scotch are foremost. The rivers Tweed, Tay, Dee, Don, and Spey teem with this noblest of the finny tribes, whose capture is a fluctuating but very valuable division of

Hosted by Google

industry, and an attraction to anglers from the most distant parts of the kingdom. The Irish rivers glisten with salmon, which, however, until lately, were not sufficiently cared for, from an economic point of view.

A trade in salted cod, wet and dry, is carried on with St. John's, Newfoundland, the head-quarters of the British fisheries on the Great Bank, where the fish taken into St. John's for exportation are chiefly caught.

Shell Fish.

Shell-fish, as various forms of crustaceans and mollusks are called, provide us with a large amount of food. There is a lobster fishery along the rocky coast of Yorkshire, another in the Orkneys, and thousands of lobsters and crabs are caught yearly on the south and west coasts of England, to be sent to the London markets. Ireland supplies us occasionally with large quantities of lobsters, but we procure our finest from Norway, where they are carefully preserved. In the opinion of naturalists we might quadruple at least the produce of our own shores.

Prawns are "potted" on the south coasts, and shrimps are netted on most shallow shores; Boston, Lynn, and Leigh, near Southend, supply the choicest kinds. One eminent firm alone pays from £800 to £1,000 a year carriage for this tea-table luxury. Just now the greatest quantities are obtained from the Briel, *viâ* Harwich; these are the *red* shrimps of the trade.

All round the coasts of the islands are spots noted for oyster culture. The finest variety is that of the Whitstable native. For some years past an increasing dearth in the supply, arising from climatic influences, or, as some think, from the destruction of the spat or young oysters, through careless dredging, has made the choicer sorts an indulgence only within the reach of the rich, and has directed the attention of the Government to the subject. The oyster occurs chiefly in estuaries, the Thames, the

Hosted by Google

Wash, and the Severn all having extensive beds, as have likewise some of the estuaries of Ireland.

Great quantities of mussels aggregate on the rocks, attached by their byssal threads, and are used for food, mainly in the towns near their growth, while still more are used as bait. It is computed that from thirty to forty millions of mussels are gathered for these purposes annually in the Firth of Forth.

Enormous quantities of periwinkles are eaten where they can be easily obtained, principally by the humbler classes of society. Other mollusks, as the whelk, the scallop or pecten, and the cockle, are brought to market, but in importance do not approach those described.

Whale Fishery.—To call the whale a fish, and its chase a fishery, is in either case a misnomer; yet, industrially, there is a relation between the sea fisheries and the whale fisheries. The economic products derived from the *cetacea*, with which we may place as a trade alliance the *phocidæ*, or seal tribe, and some large fishes, are oils, seal-skins, furs, baleen or whalebone, spermaceti, ambergris, and ivory, derived from the walrus and narwhal. Tasmania now despatches the greatest number of vessels to the Southern Sea; Hull, in England, and Peterhead, in Scotland, are the chief ports identified with the whale fishery of the northern seas.

Hosted by Google

CHAPTER VII.

EUROPEAN ANALOGUES OF GREAT BRITAIN.

Analogues or Counterparts of Great Britain—Analogues of Mining Industry—Of Animal Produce—Of Vegetable Produce—*Rationale* of our Corn Commerce.

SIMILAR geological and climatic conditions yield analogous results in the flora and fauna of a country, and in the industrial pursuits of populations. Such analogues have already been shown between the United Kingdom and many parts of Europe. We exchange little raw produce with the people of the Continent, but we fetch and carry for our neighbours the crude materials of other soils and climes, and make our country the emporium of trade. Let us illustrate this by a few examples.

ANALOGUES OF OUR MINING INDUSTRY.

The departments of France, with scarce an exception, contribute individually to the mineral wealth of the empire, and their mines produce the largest amount of iron next to England. The most productive mines are those of the provinces, whose geological structure ranges across the Channel, takes in the Norman islands, and is identical with the formations occupying the south-west of England and Wales. The Ardennes, again, are part of the rugged borders of Belgium, where iron mines are so numerous that, for its size, the country is richer than England. The region between the Sambre and the Meuse resembles the Staffordshire "Black Country;" Dudley and Wolverhampton find their counterparts in Liége and Namur. French coal is principally dispersed along the flanks of the rocks stretching from Brittany to Switzerland, which rocks, with the Alps, make the division between northern and southern Europe. Modern industry has caused the French coal-

Hosted by Google

mines to be extensively worked, though the produce is not of the best quality. Belgium, within its narrow borders, possesses twice as many coal mines as France. A great field, resting on Mountain Limestone, extends from Aix-la-Chapelle to Douai, forming basins, of which those of Charleroi and Liége are the most important. The coal mines of Liége have been worked for seven centuries without making a serious impression upon the deposits.

Germany, and Prussia especially, possesses coal and iron ores of all qualities in abundance; but the distance between the mineral beds and the limestone quarries, with heavy transit charges, impedes the development of iron industry.

Some of the rocky islands of Norway consist entirely of iron ore, and the finest quality produced is from Sweden. But here again carriage is so difficult as to render the metallic treasures of many districts in Scandinavia of no avail. Iron, copper, tin, and coal are dug in the Russian provinces near the Gulf of Finland, the largest works being situated on Lake Onega.

ANALOGUES OF ANIMAL PRODUCE.

The sheep bred and reared in Saxony and Spain produce respectively a long silky fleece—the finest quality manufactured—and merino wool, a variety also of very high value, both of which enter into our manufactures. The alluvial plains of the Low Countries and Denmark are the counterparts of Ireland. Enormous imports of cattle, butter, cheese, poultry, and eggs, from these parts, supplement our home supplies. During the few years that the foreign trade in cattle has been free, its development has been very rapid, the rate being 400 per cent. in ten years, and it is still increasing. The proximity of the Dutch to the sea has made them the fishermen, and their country the fish-market, for nearly all Europe. Formerly they took most of the fish even off the British coast; and we still

Hosted by Google

look to them for large supplies in answer to an indefinite demand for food at home.

Now it is self-evident that these countries do not require similar commodities from us in exchange, nor should we want their produce if we already possessed a surplus; but we send them manufactured goods, for the production of which they have not equal facilities; and we tranship to them the raw produce of our colonies and of foreign parts, which are wanted by the inhabitants of the civilised world generally.

THE ANALOGUES OF VEGETABLE PRODUCE

Have been already referred to. Southern Europe is eminently the region of oil and wine, with which the United Kingdom has but little in common. But adjoining this on the north is the zone of cider and beer, of which our country forms a portion. The designation of the region implies the common growth of orchard fruits, hops, and barley; but it is equally the region of green vegetables and wheat. Indeed, in all parts of Europe, excepting polar Russia, cereals furnish the chief supplies of food—viz., barley and oats in the north; rye in the next lower latitudes; then wheat, which penetrates into the districts of rice and maize, the true tropical cereals.

Our pre-eminence in wealth enables us to add to our abundance by purchasing the surplus stores of food of the whole zone. We receive great quantities of early fruits, flowers, roots, and vegetables from France and Portugal. Wheat also comes to us from France, where it is the chief agricultural product, not excepting the vine.

The Sarmatian plain is the reserve granary of Europe: enough is here produced, even without manure, to feed the whole Continent; but the means of transit are so bad, that much good corn is left to rot upon the ground, and a considerable part takes two years in reaching a port for shipment.

The low lands of Prussia wave with great growths of wheat and other cereals, enabling its eminently agricultural people to provide for various unproductive provinces, and

Hosted by Google

still to have an excess. Recent political alterations of territory have made the Prussian corn exports at least as valuable as those of Russia.

Enormous as is the produce of the United Kingdom, it is far below the demand for food for man and beast. Such a state of things may be safe during peace and prosperity, but would be very dangerous in the event of an invasion. Almost every part of the earth capable of growing corn sends grain to the British market; freights of wheat arrive in England from the United States, from the ports of the Baltic and the Black Sea, from Spain, from the Danubian provinces, and from Turkey and Egypt—countries where an elastic growth expands or contracts in conformity with the demand. In Egypt, wheat is a winter crop. Our imports are influenced by the changes of temperature, causing fluctuations of value, and rendering the trade in corn very hazardous. If our home harvest promises abundance, our demand abroad is lessened, and farmers and merchants hasten to market to ensure sales; but if a fear of scarcity arise, they withhold their stores, in the view of higher prices; and the harvests of other countries compete, till prices again are equalised.

The insight which farmers and merchants have gained from experience ministers to human well-being; for high prices warn us of probable dearth, and enforce economy, while low prices add to our enjoyment by removing any dread of the future. If the harvest fails, we are prepared with stores laid up by speculators, who have acted as scouts, and have well earned the extra profit gained by their forethought. If the harvest turns out unexpectedly good, our caution has done us no harm. The judgment exercised by the merchants must be measured by their profits, by which, therefore, they may, in the absence of any monopoly, be measured as benefactors to society. Yet, in former years, to speculate in corn was a crime, and "forestallers" and "regraters" were punishable by law.

Hosted by Google

CHAPTER VIII.

THE BRITISH EMPIRE: BRITISH COLONIES AND POSSESSIONS.

General Description—The Colonies considered in their Climatic Zones—British North America—Zone of Wheat and Northern Grains—Produce of the Warm Temperate Zones—Australia—South Africa—Indian Possessions—West Indies and Central America.

THESE descriptive examples of analogous produce between the United Kingdom and various European States show that our commerce would be very narrow if limited to Europe. But British produce, properly so called, is represented by our colonies and possessions in every part of the globe. Regarded in this light, it embraces nearly every known commodity, and explains our supremacy in commercial interchange. To arrive at a clear conception of so important a subject, it is necessary to possess a double knowledge, first of the range and nature of commodities included in the term British produce; secondly, of the conditions of their production. An acquaintance with geology will enable us to trace the economic history of the inorganic or mineral division of those commodities, while the aid of physical science is generally required to elucidate the more complex phenomena of organic or animal and vegetable produce.

Whether or not climatic influences originally affected the deposition of the useful minerals, we cannot discern among them any present relation to zones of temperature. Minerals, metalliferous or otherwise, are grouped in certain formations at the pole, or at the equator. Gold is found in the frosty Urals, and in the sands of Africa; copper in Lapland and Australia; tin in Cornwall and in the Straits Settlements. We must study the produce of the mineral kingdom as best we may, but remember that it is only the zones of climate which determine the varieties of organised

Hosted by Google

life, and systematise our investigation of animal and vegetable produce.

THE COLONIES CONSIDERED IN THEIR CLIMATIC ZONES.

The isothermal zones, or zones of equal temperature, correspond but very irregularly, and in parts not at all, with the parallels of latitude, being disturbed by every new combination of the elements of climate. The absence of land, for instance, causes the southern hemisphere to be cooler in summer than the northern hemisphere, while the equable climate of the ocean presents fewer marked deviations from parallel bands. The zones have been variously designated according to the prevailing character of their productions. Grain, being more widely spread and more largely produced than any other food substance, is the product most usually applied as a descriptive term. Equatorial grains are maize and rice, the latter of which is supposed to feed as many of the human family as all the rest of the cereals put together. Wheat blends with these grains in both hemispheres, first as a winter crop, and afterwards as a summer crop. Still farther from the equator, wheat grows along with rye, barley, and oats, the so-called northern grains, which extend into higher latitudes where wheat disappears.

The following approximate chart will now assist us :—

Zone.	Approximate Latitudes.	Characteristics.
Tropical . .	0° to 23·5°	Intense vitality, rice, maize, palms, spice, sugar. Carnivora.
Warm Temperate	23·5 ,, 45	Wheat and tropical grains. Olive, citron, grape, fig. Domestic animals.
Temperate . .	45 ,, 55	Wheat and northern grains. Orchard fruits. Forest trees. Domestic animals.
Sub-Arctic . .	55 ,, 66·5	Northern grains. Berries. Pines. Fur animals, bears, seals.
Arctic . . .	66·5 ,, 90	Mosses and lichens, saxifrage. Lowest vitality.

Hosted by Google

I. Arctic and Sub-Arctic Zones: British Colonies (Northern Grains).

The only parts of these zones under British rule are the great territories of North America, which, in the hands of the Hudson's Bay Company, have long been famous for their produce of furs, for which, indeed, the whole zone is the world's hunting ground. The marine produce of the region has been referred to in describing the British whale fisheries and the Newfoundland cod fisheries. There are no British possessions in the sub-arctic portion of the southern hemisphere; Cape Horn is the only point of mainland reaching 55°.

II. Temperate Zone: Zone of Wheat and Northern Grains.

The climatic limits of this zone, in the northern hemisphere, are more irregular than the boundaries of the warmer zones, being subjected to the variable physical influences which characterise the temperate regions. This irregularity is greatest amid the broken coasts of Europe, where the configuration of the land adds to the deflection caused by rains and winds not periodical, and by the Gulf Stream. It is, therefore, with an elastic meaning that we speak of the width of the zone in degrees. The zone is determined northward by the line where wheat ceases to ripen, and southwards by the limits of the ripening of the grape. The limit of wheat in Britain is at Inverness, in latitude 58°, whence it is deflected across the North Sea to Drontheim, in Norway, in latitude 64°, and waves onwards to St. Petersburg, in latitude 60°, whence, varying with every local circumstance of climate, it passes through the Old World to the coast opposite Saghalien, in latitude 48° or 50°. Westward the same line sweeps across America, from the low latitude of 45° in Nova Scotia, rising in a broad curve to 48° or 50° on the Pacific side of the continent. The climatic line of the vine cuts the Biscayan coast of France, in latitude 45°, whence it is deflected to

Hosted by Google

Berlin, 52° 31′, and afterwards passes on through Europe and Asia, in a wave gently tending to the lower latitude of 40° north of Corea. The same line reaches its lowest latitude in America, which it traverses nearly coincident with the parallel of 36°.

This great girdle comprehends the European plain, and a vast but nearly unknown strip of Central Asia. Westward it takes in the northern states of the American Union, and the British Confederation, of which Canada is the centre.

The corresponding zone in the southern hemisphere has fewer irregularities; it tends slightly nearer to the equator, and its outer limits have not yet been defined. The extreme part of Australia barely enters the zone, which is best represented by Tasmania and New Zealand, although Patagonia, bending furthest towards the south pole, is the greatest tract of land within it. Except our own islands, no part of the northern zone of the Old World, from the Atlantic to the Pacific, belongs to us. Throughout this extensive region, while every country has its specialities both in climate and produce, there is a general resemblance—a unity in diversity—which extends to both hemispheres. The general aspect of the vegetation may differ in each country, and yet be constituted of plants closely allied. While describing, therefore, the produce of our colonies, we describe generally that of the whole climatic region.

The part of Europe comprised in this zone is indifferently named the cider and beer, the butter region (distinguishing it from the division of the oil and wine countries adjoining), the region of summer grain, or of deciduous trees. Such descriptions indicate the nature of the produce. Thus, butter associates itself with pastures and oxen, and with dairy produce.

Inferentially it leads us to the consideration of the domestic animals, both for burden and food—to hides and

Hosted by Google

skins, and wool for clothing. We have already illustrated the production of these in our own country. Let us now cross the Atlantic, and survey the produce of Canada. The same commodities reappear, and form the chief bulk of the wealth of that confederation. Our largest supplies of timber and of forest products come from Canada; the quantity of wheat produced is almost incalculable; and of provisions there is an ever-increasing store. If we go to the antipodes, the resemblance is still more remarkable. What is the chief produce of New Zealand and South Australia? Timber, minerals, cereals, cattle, and wool. If the difficulties of transit shall ever be overcome, a transfusion of useful produce will eventually take place in the two hemispheres. And all this is British produce—the aggregate upon which is founded our commercial intercourse with other nations.

III. Warm Temperate Zones: British Produce. Wheat and Tropical Grains. Olive, Citron, Fig, Grape. Domestic Animals.

The warm temperate zone is well defined, and displays interesting correspondences throughout its circuit. In the northern hemisphere it is the whole region between the line of vine culture and the tropic of Cancer; in the southern hemisphere, it is the band cut off by the tropic of Capricorn from the American, African, and Australian continents. Of these southern lands, Cape Colony, Natal, and Australia are British colonies. In the northern zone, the only parts belonging to us are the Mediterranean stations of Gibraltar and Malta.

Australia.—Scarcely separated from the Indian archipelago, with its northern parts purely tropical, Australia exhibits a distinctive character, differing from the exuberant life of the East Indies as much as the English settlers now spreading over its surface differ from its aborigines. Indigenous elements of wealth on this continental island are few, though important. Gold mines have for a long

Hosted by Google

while annually yielded many millions sterling, most of which has arrived in England. Copper also has been obtained from mines—probably the richest known. Economic plants and animals were few, till introduced by the colonists. The kangaroo was the largest quadruped; it has been displaced by the sheep, and is becoming extinct. Cattle, multiplied beyond enumeration, roam over the plains, and meat is exported to England. Of animal products, the chief is wool of excellent quality and unlimited quantity, the supply becoming gradually our mainstay for home manufacture. Tallow is obtained by boiling down the sheep, the perishable nature of their flesh giving them hitherto only nominal value as food. Salted or wet hides are exported in large numbers by the colonists, who have lately also prosecuted with great activity the sperm whale and South Sea fisheries. Like all the English race, they have a strong predilection for tea, which has made them attempt its cultivation, and with such promise of success that they begin to export part of their produce.

South Africa.—South Africa resembles, in its economic aspects, the corresponding latitudes of Australia. The two are our great sources of supply for wool. From both we obtain hides and skins in large numbers. The Cape farmers, by cultivating the vine, have made wine one of their exports, and Australia emulates the example. Ivory is another of the commercial products of the Cape.

Tropical Zone: British Produce. Rice, Maize; Palms; Spice; Sugar. Intense Vitality. Carnivora.

In the torrid parts of Africa there are settlements important commercially, if not in extent. Sierra Leone and the Guinea coast are names of fatal import, from the deadly pestilence which their valuable produce tempts the merchant to brave. Gold, hides, ivory, wax, teak, dye-woods, and palm-oil, form the staples of production in these settlements.

Hosted by Google

Off the opposite coast of Africa, the Mauritius represents the tropics in its chief produce—that of sugar—to which it adds the allied commodities of molasses and rum.

Indian Possessions.—Far larger than our African possessions is our Indian empire, comprising British India, Ceylon, Singapore, and the Straits Settlements. Hindostan is so large that our other Indian possessions are in danger of being overlooked, although their produce is of the highest importance. And the corresponding Indies of the New World, including the Bermudas and Belize, are of no mean consideration. By inference we know that these countries will produce the raw materials of the zone in which they are situated, whether animal or vegetable; and only in the case of minerals will there be any great divergence. Viewing, then, the tropics generally, we see life in its intensest phase. Not only are individuals numerous, but species have greatly increased in number. Amongst animals, the carnivora reach their highest development. Flowers exhibit the brightest colours, and secrete the strongest essences; whilst the buds, blossoms, leaves, root, bark, and wood yield the pungent aroma of spices, with narcotic principles, and dyes, such as only arrive at perfection under the rays of a vertical sun.

India.—India well typifies the whole girdle of the tropics in the variety, exuberance, and value of its raw produce, which almost equals half that of the other British possessions combined. Of food substances it produces immense quantities in the forms of rice, sugar, coffee, and spices. Of materials for clothing, wool and silk of valuable qualities are produced; the Cashmere shawls made from the former being unsurpassed for softness and beauty by the products of our best looms. Vegetable fibres find India their most prolific home. Cotton has been an Indian commodity from the most ancient times. It was our sheet-anchor, and saved our staple industry from wreck when the war-storm passed over America. Kips or small hides from

Hosted by Google

wild cattle of the interior, are produced extensively, differing from the hides of Australia and South America, which are larger and salted, and thus receive the name of wet hides. Indigo and numerous dyes; opium, and many other drugs; tanning substances; gums, resins, and balsams; teak oak for ships; timber for building; cocoa-nut and other palm oils; and a thousand miscellaneous commodities reach perfection in this region.

Ceylon.—Ceylon varies somewhat, from the prominence which cinnamon and oil take amongst the raw produce, and in the relatively smaller cultivation of rice. It is the chief home of the cocoa-nut palm, as Arabia is of the date; and coffee is much grown. Ivory is a valuable product of the island; and the pearls are of great renown, although new Australian grounds already vie with this famous fishery.

East Indian Islands.—The pepper vine, the nutmeg, and the clove are indigenous to the East Indian Islands—the botanical centre of spice-producing and aromatic plants. The chief spice islands belong to the Dutch, who still maintain the strictest monopoly of the produce. Though grown elsewhere, the quality is inferior; and these spices, like tea, are examples of plants that perfect their powers within limited areas. Other tropical substances, some of which are unique, are produced, such as the hydro-carbons, gutta-percha, caoutchouc, camphor, and gamboge—both in tears, or pure lumps, and as extracts—and ebony.

Minerals are richly spread over the whole archipelago. Diamonds are obtained from Borneo, and gold from all the larger islands. Banca possesses tin mines as rich as those of Cornwall, and as easily worked, the ore being near the surface.

West Indian Possessions and Central America.—From the West Indies and Central America we obtain sugar, rum, coffee, rice, tobacco, and cigars, of which last those from Cuba are accounted the finest; mahogany, and other timbers; dye-woods, as fustic, logwood, Nicaragua wood. Many of

Hosted by Google

these products are equally the growth of Guiana, in tropical South America, from whose exuberant vegetation we obtain the cacao, or cocoa, of which chocolate is made; fruits, tapioca, bark; together with representative forms of the flora of the East.

The similarity of produce throughout the tropics cannot fail to be observed. The natural dispersion of plants and animals, and the transference and diffusion of species by human agency, have increased the area of growth almost without limit; have made the good harvests of one country compensate for failures elsewhere; have added to the stores of food and clothing, and other necessaries; and, by so much, have added to human life and happiness. These results have rewarded human industry and intelligence ten thousandfold, and they ought to encourage us to extend the sphere of knowledge to its widest bounds.

Hosted by Google

CHAPTER IX.

FOREIGN PRODUCE: EUROPE.

Interchange of Surplus Produce with European Countries nearest to England—The Vine—Wheat—Productions of Spain and Portugal.

In our survey of the raw produce of the British Empire we have gained a knowledge, not only of the great variety and abundance of natural substances necessary to our well-being, but also of the surplus which we can offer to other countries in exchange for their productions, so as to add to our wealth. To understand the nature of these productions we must learn something again of the countries that produce them. It will be convenient to study such countries in the zones of climate to which they belong. Incidentally we have already done this, inasmuch as the detached parts of the British empire are dispersed through every zone. We have seen that organic products spread from certain centres, according to their natural powers of selection, as well as by human agency; and that they either extend their bounds to the utmost limits of the zone of their growth, or, crushed by stronger types of life, they die out, thus illustrating the law of the "survival of the fittest." In assigning to every organic product its own climatic region, where alone it reaches the highest excellence, Nature has made interchange a necessity.

Next to the produce of the British Empire, we are interested in the produce of the countries nearest to us, for it is with these countries that the system of interchange begins.

EUROPE.

Three climatic zones are well defined in Europe: they are the warm temperate, the temperate, and the boreal. Each of these zones is disturbed by local deviations,

Hosted by Google

produced by the mountains and other physical causes, and is divisible into sub-zones of produce, with outlines less clearly marked. Southern Europe is bounded by the Mediterranean, into which sea mountain-spurs trend southward, the lateral outspread of which forms the peninsulas of the Morea, Italy, and the insular line of Corsica and Sardinia. The inland boundary of this southern zone is the line of vine growth, which we have already referred to, sweeping across Europe south of the limits of 45° on the coast of the Bay of Biscay, and 55° on the northern coast of the Caspian Sea. The vine flourishes in every part of this region, which is distinguished by the name of the *Wine Countries*. Nevertheless, the subdivisions of this zone possess an individual character. An elevated ridge line, traceable from the cliffs of Brittany, across the extinct water-filled craters of Auvergne, to the Alps, and thence onwards to the Carpathians, divides the sunny south from Northern Europe, and defends it from the boreal winds. The region is unique for beauty and fertility. Clear air gives an extensive view of the landscape, and the sun, pouring down its rays unarrested by vapour, draws from the fruitful ground the blended produce of the tropics and temperate zones. The southern parts of Spain, Italy, and Greece even trench upon the region of palms, which bear fruit in several places, but elsewhere only develop their regal crown of leaves. The slopes of Etna are girdled with bands of vegetation, exemplifying horizontal zones of growth, from the date-palm, cotton, sugar-cane, pine-apple, and prickly pear at the base, through citrons and evergreens, and a wooded region of leaf-shedding forest-trees, that hybernate in winter, upwards to the stunted vegetation of colder lands, and sterility round the crater. In Naples the cotton plant divides the field with the hemp and flax, and the fig attains perfection almost alongside of the oak and fir. Between Naples and the Alpine ridge, in Switzerland, every diversity of the zone is encountered. South of the mountains the *olive* "swells

Hosted by Google

with floods of oil," almost as bounteous as water, and as freely used; the few parts subject to local frosty winds, where it will not grow, being too unimportant to rank as exceptions. It is the representative plant of the sub-zone, and is indigenous; whereas the orange and peach, the grape, cherry, and fig were brought from Asia, and maize was a gift from the New World, in return for the European cereals and domestic cattle. The Alpine heights, in strong contrast with much of Italy, endure an arctic climate. The valleys alone can be called fertile, and there is elsewhere scarcely any soil. It is only as the resultant of many differences that we include the whole region in one climatic zone. The *facies* or physiognomy of the vegetation is complex. The vine and its attendant cereal, wheat, are distinctive throughout; but the almond, olive, fig, citron, and sweet chestnut, together with the cork oak, myrtle, and other evergreens, the almond, fig, and the lily tribe, are only common in the warmer parts.

The Vine.—Although the vine ranges as widely as wheat, it is for vintage purposes of little avail farther north than 45°, going off beyond that into leaf, and running to waste on approaching the equator, where also wheat is no longer profitably grown. The vine, like the annuals, requires a certain amount of heat to ripen its fruit, and bears a cold winter better than a cool summer. This heat may accumulate, in warm latitudes, between March and September; while in Scandinavia, where the whole operations of husbandry are completed in three months, and barley is sown and reaped in seven weeks, the necessary amount of heat rarely occurs. It is not by any means the line of mean annual heat, but the amount of seasonal heat, that fits or unfits plants for certain latitudes. Beyond its natural limits the fruit of the vine can only be extorted from the soil by labour and skill, while, in its own zone, "profusion is lavished on the ignorance of the vine-dressers of Italy, and on the indolence of Spain."

Hosted by Google

In France, the vine is pruned down to the size of a gooseberry bush, and the vineyards consequently lose interest in the landscape; but in Italy vines cover the hill terraces, and twine among the pollard elms and olives. The pendent racemes or bunches of purple fruit are of delicious coolness and flavour in health, and a grateful refreshment to the fevered tongue in sickness.

Raisins.—As a proper food product, the dried fruit of the vine is of no little importance, and many commodities could be better spared than the "plums" of common language, and the so-called "currants," British taste for which is so marvellous, that a failure in the Spanish or Greek crop would be felt like a national calamity. Plum-pudding is an established Christmas institution, and poverty can give no sharper sting to the poorest household than to deny a share in this festive rite.

Wheat.—Wheat reaches its greatest perfection throughout the wine countries; but it also flourishes in other zones, and therefore does not so well serve as a type of a region to which the vine, for vintage purposes, is limited. Wheat grows within the tropics as a winter crop, but other grains grow there to greater advantage; thus, on approaching the tropics, we see it gradually displaced by maize, and then by rice, the true tropical cereals. Andalusia produces wheat as fine as any in Europe, and is the storehouse of the Peninsula. Nature has endowed Spain with gifts that would make it the paradise of a wealthy and powerful nation, did not the perversity of man frustrate the design. With a climate and soil fitted for the finest agriculture, only a third of the land is arable; and, though the harvest is abundant, the corn is oftentimes left to rot upon the fields, the cost of transit being too great, owing to bad roads and banditti. Corsica and Sardinia were the granaries of ancient Rome. In Italy the arable land is covered with the grateful shade of the olive and mulberry, and the vine, trained over rows of trees, produces a shade beneath which cereal crops are

Hosted by Google

raised. The plains of Lombardy comprise some of the richest vegetable soils, from which four or five wheat crops can be got in succession. Vast breadths of corn again grow upon the plains of Hungary and the Lower Danube. Northward, France and Germany produce large crops; and still heavier ones of wheat, rye, and oats are met with amongst the sandy and swampy lowlands of South Russia. The scene of Russia's extensive but rude agriculture is a tract of black, thick, vegetable soil, equal in area to France and Austria combined, which produces rye—the people's chosen grain—and limitless stores of wheat. This region is bounded by the Great Steppe of the Cossacks, and the saline steppes of Astrakhan. The latter of these boundaries is so impregnated with salt as to be fertile only on the narrow margins of the rivers; but spring clothes the arid soil of the Great Steppe with a rapid growth of thick coarse grass, upon which troops of horses are pastured.

Thus the vine and wheat, with equal propriety, may stand sponsors for this European region, which is also known as the region of the *Oil Countries*, from the free use everywhere made of the product of the olive, although it does not flourish so far north as the vine.

The subdivisions of the zone display distinctive physical features and productions, and an individual character is impressed upon each of the countries forming the subdivisions. Spain differs from France and Italy, and these countries from Germany, Austria, Turkey, and Russia, and from one another, while all are characterised by the grape, wheat, and the olive.

Southern Subdivision: Physical Features and Produce.

Spain and Portugal.—The arid and treeless table-land of the Peninsula betrays its proximity to Africa, and the geological formation of its southern boundaries indicates a former union with that continent. The table-land occupies the whole of the centre of the country, its mean elevation being over 2,000 feet. It is not one plain, but consists of a

Hosted by Google

series of terraces, blanched in the summer sun, and subjected to great extremes of cold in the winter. These terraces, rising upwards towards the steep and difficult acclivities of the Pyrenees, are separated by mountain ridges, of which the Sierra Nevada is the highest, and by rocky gorges, at the bottom of which the rivers flow, at the depth sometimes of 200 feet. Numerous fertile valleys slope down to the shore, where the rivers, useless for irrigation on the table-land, revive the vegetation. The stately chestnut-trees congregate in forests, and the cork and evergreen oaks yield their bark and galls, as well as sweet mast, which is ground into meal, and, like the chestnut, used for bread. Orange groves perfume the air with their flowers; and the golden fruit hanging at the same time from the boughs recalls the fabled garden of the Hesperides. The Biscayan coast, open to the ocean breezes, produces cider and the fruits of a higher zone; but the Mediterranean seaboard, defended by a rampart of inland elevations, is tropical in its warmth. Peaches gain the fulness of their flavour, and melons reach their highest perfection, while pine-apples, figs, and prickly pears grow in every garden. The harvest of hazel-nuts is so great, that, besides what are eaten in Spain, every fruiterer in England shares in the produce. Barcelona, in connection with nuts, of which the surrounding district furnishes the finest variety, is a household word in our own country. The almond and the palm flourish together. The flowering aloe, rare in Great Britain, here forms the country hedges; and all kinds of lemons, limes, and citron are excellent and abundant.

With the minor botany of Spain several important industries are associated. Bees find a plentiful repast in the myriad flowers, and honey is produced to a very large extent. Cochineal insects feed upon the cactus; their nurture and the cultivation of their food are so successful that Mexico—the original source of cochineal—is now of less importance than formerly through Spain and the Spanish islands.

Hosted by Google

Silkworm-rearing employs a large number of the Spanish people. Of still greater importance in animal produce is the merino sheep, whose fleece is of high value; and the famed barbs of Andalusia are amongst the most beautiful of horses. The institution of the *Mesta*, by which baneful privileges were granted to the nobles and priests, who held a monopoly of sheep-farming for generations, protected pasturage at a disastrous cost to agriculture. This institution arose in feudal times; its abuse has obstructed husbandry, while the sheep have in consequence been improved neither in breed nor number. No field once in grass might be ploughed without the sanction of the Mesta, who had a right of way and of pasture, in perpetuity, between the lowlands and the table-lands.

Minerals.—Spain possesses at Almaden the richest European quicksilver mines, without which the gold and silver ores obtained from America were, till recently, of little use; the quicksilver being employed to separate the precious metals from their matrices. Lead is found in sufficient abundance to allow of export; but generally, the mineral treasures of Spain, once of national concern, were neglected upon the discovery of America, and the mining industry of the mother country is now only very slowly resuming its proper position. The Peninsula commands the Mediterranean and the Atlantic, and is well placed for communication with the whole world. In the sixteenth century, the two kingdoms of which it is constituted divided South America between them, Spain also possessing Mexico and Central America, and for enterprise the Portuguese and Spanish were the first nations in the world. In the present day their commerce is possessed by foreigners, and almost entirely confined to France and England. Spain, however, has made important advance within recent years.

Mediterranean Seaboard.

France and Italy.—France, like England, is a manufacturing nation, importing raw materials and sending out

Hosted by Google

finished goods. Nevertheless, it is the chief wine country, and produces beet sugar in abundance, besides a surplus of corn, madder, and fruits for export, as well as many millions of eggs. The mulberry trees that cover a large part of the southern provinces constitute the basis of an important branch of national industry. Although the quantity of silk does not equal that of Italy, yet the silk fabrics of France have hitherto been unexcelled. Iron, coal, lead, and zinc are amongst the minerals of the south of France, iron being specially abundant in the Pyrenean districts. France, washed by three seas, is admirably placed for interchange, which, during the reign of Napoleon III., has more than quadrupled in value and extent.

Italy is naturally a land of abundance. It is also the chief silk-producing country of Europe, and yields the best olives and olive oil, straw for plaiting—Tuscan and Leghorn plait being universally admired—sumach and bark for tanning, a fine hemp fibre, and fruits like those of Spain. A large proportion of the people, however, lack the necessaries, not to mention the comforts of life, and those who sow and reap her bountiful harvests are often without bread. Many parts of great beauty and fertility are unhealthy, and districts once crowded are now deserted, owing to pestilential malaria.

The mineral resources of Italy, though vast, are to a great extent undeveloped. They comprise marbles, alabaster, serpentines, boracic acid, sulphur, rock salt, various ores, as those of copper, iron, lead, silver, mercury, and antimony, together with mineral fuel and oils.

Fisheries.—The Mediterranean sea-board, both of France and Italy, is notable for its fisheries. The delicate anchovy, preserved in salt, and the sardine, preserved in oil, are exported in large quantities. The sea, enclosed by Naples, Sicily, and the islands westward, is the chief scene of the tunny fishery. This fish, sought for its oil as well as for food, represents the mackerel of the British seas, as the

Hosted by Google

anchovy and sardine represent the herring tribe. Along the Barbary coast and off some parts of Italy, French and Italian dredgers engage in the so-called fishery for coral (*Corallium rubrum*). Only in these parts is this dense and beautiful but brittle product found in abundance, employing not only the dredgers, but the lapidaries of Marseilles, Genoa, and Naples, by whom its beauties are so developed that its value often increases to double that of gold, giving rise to interchange with Persia, China, and the most distant countries. The cutting of cameos in imitation of the ancient onyx, which is provided for by the prevalence of beautiful gasteropod shells, is an industry allied to that of the coral, and carried on in the same towns.

Region of the Danube.—The Alps send out eastern spurs, with glacier scenery and yawning abysses only next to the main range in grandeur. These spurs, with the still more rugged Carpathians and the Turkish Balkans, give a general mountainous aspect to this region, modified by the corn plains and grazing grounds of Hungary and the marshes of the Lower Danube. Spring clothes the meadows in green, amidst which the daffodil, narcissus, and other liliaceous bulbs, grow in wild, native vigour, while sheep and cattle find a rich sustenance, and add greatly to the wealth of the land.

The Danube flows through countries less developed than France and England, and their condition reflects itself in their produce. The surplus for interchange consists almost wholly of raw materials. Nearly a fourth part of Austria, and probably a larger proportion of Turkey, are in forest, and here many of the finest timber trees reach their most perfect state. Oak trees abound, productive of gall nuts, of valonia for dyeing and tanning, and of a sweet acorn, flavoured like the chestnut.

The forests of the Austrian empire are attendant upon inexhaustible mines, for though the coal-fields, both of the Hungarian and German provinces, are far from inconsider-

Hosted by Google

able, either in point of area, or produce, the quality of the coal is bad, and wood is much used in smelting. The mines have been worked from the time of the Romans, but never extensively, and little impression appears to have been made upon the mineral stores. Iron is found in nearly all parts of the empire, especially in Bohemia, Moravia, and other German provinces. Some of the mountains are formed of a pure carbonate of iron, requiring to be quarried rather than mined, and native steel of the highest excellence is found in Styria. The richest European mines of quicksilver, next to those of Spain, are met with in Idria, in the province of Carniola, Austrian Germany. An old proverb says of three Hungarian towns, in allusion to the richness of their mines, that one (Neusohl) is enclosed in walls of copper, another (Schemnitz) in walls of silver, and the third (Kremnitz) in walls of gold.

Wool, silk, and metals are the chief raw substances exported by Austria, whose unwise policy in restricting commerce, in view of keeping her produce for home consumption, has resulted in the discouragement of industry, hindrance to the increase of wealth, and the promotion of extensive smuggling.

Turkey and Greece produce—besides silk, madder, figs, raisins, valonia, and olive oil—some substances more especially their own, as opium, cotton, drugs, and sponge. The fisheries of this last assume, in the Ægean Sea, the place of the Italian coral fishery. Strewn over the rocky floor of the clear water where the Cyclades repose, sponge cups abound, soft, elastic, absorbent, and free from spicules, siliceous or calcareous. Those from the coast of Candia (Crete) are of the finest description, and under the name of Smyrna, or Turkey, or Greek sponges, command the highest price in the market.

Alpine Ridge.—The climate and soil of this dividing tract are unfavourable to animal and vegetable produce, and nothing economically important characterises it. The moun-

Hosted by Google

tains, as their geological structure indicates, are deficient in metals and useful minerals. The Swiss are, nevertheless, well clothed and fed; while Italy, so much more bountifully dowered by Nature, depends upon foreign industry for the scanty supplies of half her population.

Northern Slope.—While the olive and orange flourish only in the lower latitudes of this favoured zone, the vine reappears on the northern slopes, and furnishes many of the finest wines. The climate and soil are equally favourable for cereals and for the rearing of domestic animals.

Zone of Wheat and Northern Grains.

Beer and Butter Countries.—The designation of the "wine and oil countries" contrasts with that of the next higher zone, whose distinctive produce has gained for it the appellation of the *Beer and Butter Countries.* The two descriptive beverages are linked by the cider, common for some distance to both sides of the line of division. The production of cider, beer, and butter, indicates essential differences in climate, soil, and other physical conditions, from the zone of wine and oil. The shades of change upon the face of Nature are very distinct over large areas, but too gradual for comparison within narrow bounds. The outskirts of one zone transfuse with the adjacent climes; but the zone itself emerges, in its own unique character, as distinct as a band of the rainbow from the lines with which it blends. Receding, therefore, farther from the tropics, the glare of southern lands is subdued by green pastures, the sustenance of fine cattle and sheep; the brilliant blue of the skies is sobered with grey clouds, from which pour more frequent showers, if not such torrents of rain; and the ocean assumes duller greenish tints. The varied surface of the zone favours the production of excellent crops of all kinds of cereals, and fine timber. The appearance of the vegetation is the combined effect of meadow-land and forest, of cereal and root-husbandry, of orchard fruits and fibres. Vineyards rapidly become fewer, maturing only quite inland,

Hosted by Google

and wine is no longer a common drink. Before reaching the mean limit of wine produce, the hilly districts of Germany present interesting illustrations of the climatic conflict of plants. The vine-clad hills of the Upper Rhine and Moselle strike the beholder as much as the farming of their vicinity, which is that of a more northerly zone. Over the plateaux of Bavaria and Bohemia also, lofty and graceful curls of hop, with loose hanging cones of fruit, challenge comparison with the vineyards of the Rhine and the trellised gardens of Italy. Choice wines are made in a few places, but Bavaria is most celebrated for its beer, of which the inhabitants consume a great quantity. A wag in Munich once described a well-known toper as "a beer-barrel in the morning, and a barrel of beer every night."

In this zone, more than in any other, cultivation has changed the aspect of nature; for it includes the busy hives of England and France, and the chief mining and manufacturing localities of the Continent. Except in Russia, towns are closely packed, kingdoms are crossed by numerous roads, highways, railways, and waterways, and the seas are crowded with ships for every purpose of war, commerce, fishing, and pleasure. Each country reflects its own character, notwithstanding a tolerably uniform climate and vegetation. France is laid out with the precision of a surveyor's plan; the departments and communes are intersected by trees planted at exact intervals. Ancient Armorica (Brittany) produces apples and pears in abundance, and the orchards are more pleasing than the southern vineyards. By the law of equal division of property at death, in France, the empire has become covered with small allotments, and the hedges, which make England a garden, have disappeared. There is thus a monotony in French husbandry, from which the north only escapes by the profusion of fruit-trees. Every homestead, however, contains poultry, providing eggs, and large stores of food, besides an

Hosted by Google

immense surplus for export. Early garden and orchard produce are sent to England.

Holland and Belgium.—The Netherlands are cut into chequers by canals, fringed with perspective lines of poplars, the greenness and many vanishing points of which make an otherwise tame country attractive. The same beaver-like industry which protected the Low Countries from inundation has enabled the inhabitants to extort wealth from the rescued lands, and to make the most unlikely places of human residence the most densely peopled parts of Europe. The culture of flax, hemp, and grain—especially oats—cattle-rearing, and dairy-work, are all important industries. Holland had once the commerce of Europe in its hands, and still retains a large share. Its surplus for interchange consists of butter and cheese, provisions, cattle, and hides; flax, tow, oats, and seeds—a description of produce which extends also to the alluvial lands of Hanover and Denmark. The canals of Holland serve the double purpose of inland communication and drainage.

Where Belgium adjoins Holland it partakes of the same features, but farther south it is hilly and woody; minerals are various and abundant, including almost all the metals of economic value, together with coal, limestone, and freestone. Its mines of coal and iron, especially, create a hive of industry competing with England. The kingdom is a succession of busy towns, so near together, and connected by such populous farms, that it is like the metropolis of a great empire. The animal and vegetable produce of Belgium corresponds with that of the countries adjacent—early garden stuff and eggs as in France, and dairy produce as in Holland. Rabbits are specially a Belgian product, millions being brought from Ostend to the London markets during the cold months.

Germany.—Germany, until recently, was split up into many minor states, under different rulers, all claiming old feudal rights and privileges. The husbandry of its varied

Hosted by Google

surface reflected these political features, rather than the rapid advance in science and the arts of production exhibited by other countries. Princes and grand-dukes owned inalienably the greater part of the soil, and claimed powers of free grazing after harvest upon the fields of their tenants. This led to a persistent uniformity of tillage, and checked improvement. The northern states are now united under Prussia; the petty jealousies and restrictions which have hampered production and transport may be soon removed, and the country be immensely benefited.

Nowhere are green vegetables so fine. The cabbage flourishes so abundantly as to form a national dish, and, under the form of *sauer kraut*, is esteemed worthy of export. The beet is grown, as in France, for the sugar manufacture, which demands an excessive produce. Rye used to be the common grain, but is no longer the staple of food, and wheat of a high quality is exported by way of Dantzic, which name it commercially bears. The plains of Northern Germany—Pomerania, Brandenburg, Mecklenburg, Hanover, and the adjacent portions of Prussian Saxony—are not generally fertile, consisting chiefly of sandy heaths, forests of fir and pine, with marshes towards the Baltic, and inexhaustible peat or turf, used for fuel. The Baltic coast of Prussia has to be protected from the sea, like Holland. Along these low shores, the fossil resin called amber is found, being abundant in the long narrow tongue of land shooting out from near Königsberg to Memel, whence it is dredged from the submerged forests. Farther west, the Rhine provinces of Prussia, and the adjacent territory, present a remarkably diversified surface of hill and dale, with a soil largely consisting of the decomposed material of volcanic rock, notable for its fertility. These districts possess a climate, and yield products, approaching very nearly in their character to those of the more southerly belt.

Germany is remarkably well watered by small streams, and has good rivers for navigation, their courses throughout

Hosted by Google

the north being mostly slow, through the flat and sandy plains. The central mountain range makes an admirable watershed, dividing the basins of the Danube and the Rhine, and determining the course of the smaller rivers to the North and Baltic Seas. These rivers, and numerous lakes, abound with fish, compensating for the comparative lack of seaboard and marine fisheries.

In Lower Germany—that is, the portion lying north of the central watershed—cavalry horses are largely reared, as well as numerous sheep and cattle. The Saxony fleece fetches the highest price in the wool market, being long and silky in fibre, and producing a fine cloth.

The forests, in favourable parts, cover a third of the country. Oak, beech, and chestnut fatten with their mast immense numbers of hogs, the bristles and flesh of which are valuable economic products. The wolf and the boar still seek in places the covert of the leaves, and are hunted rather more for the sake of extermination than for produce. Timber is an important item in the national revenue. Thousands of logs float down the Rhine, formed into rafts, out of which in the course of transit a floating village is built, with labourers, their families, and appurtenances for shelter and food.

Flax and hemp are largely grown, the latter attaining sixteen feet in height, and being full of fibre. Every cotter has his patch of land, from the produce of which coarse cloths and canvas are made.

Russia.—Entering Russia through the plains of Northern Germany (Prussia), we find a repetition of the picture just described with the features enlarged. The Sarmatian plain reaches to the Urals, without an elevation to break the ocean-like level. The Valdai Hills, the feeble watershed of European Russia, limit the plain to the north, and the Carpathian plateau to the south. Through these flats flow various noble rivers and their tributaries, swarming with sturgeon, producing shagreen and isinglass, and, from the roe, caviare. The Volga meanders wearily for 2,400 miles,

Hosted by Google

with a fall of three inches to the mile, till it flows into the Caspian. This river is the grand waterway for the produce of the Urals and Central Russia, and for the commodities interchanged at Nijnei Novgorod, the great centre of inland trade, where merchandise to the amount of many millions is sold during the two months of August and September, while that mart is open. Well-laden barges float as far as the angle where the river bends abruptly towards its delta in the Caspian. For a thousand miles of its lower course the Volga runs at the base of a cliff, facing the east, and ranging from 200 to 500 feet high —the sea-wall of a pre-historic and vaster Caspian. This elevation of the right bank of the Volga renders canal communication with the Don impracticable, though a mere strip separates the rivers; the barges are lifted bodily at the most convenient spot on to a tramway, and transferred to the Don, whence they reach the Sea of Azof and the Black Sea. Here their freight is sold, and the vessels are broken up for firewood, realising more in the treeless steppes, where cow-dung and turf are commonly used for fuel, than their value if sent back empty to the forest-lands where they were rough-hewn.

Peter the Great, to whom Russia owes its impetus in civilisation, was the first to perceive the facilities of the country for a system of waterways, and he connected the basin of the Volga by means of canals with the Baltic and Arctic drainage. This scheme has since been developed, until an uninterrupted communication now exists between the Arctic Ocean and the Baltic, the Black Sea and the Caspian. For land carriage the finest highway in the world is probably that from St. Petersburg to Moscow, which is twice as wide as any of our own, macadamised throughout, and lined with trees marking the number of versts.* Several other fine roads exist, and the chief cities are being connected by magnificent lengths of railway. Still, as a rule,

* A Russian *verst* equals about three-fourths of an English mile.

Hosted by Google

the cross-roads are bad, consisting of mere tracks; and markets are so difficult of access, that much wealth is wasted, corn being a long time in reaching its outport. The boundless southern flats, not composed of marsh or arid steppes, or waving with grain, are productive of every kind of root-crop, and of hemp and flax. Russia thus, with barbaric bounty, gives to the nation she feeds linen for their clothing, and sacks in which to carry their corn.

Upon these plains, too, multitudes of horned cattle are reared, as well as millions of sheep, from which are obtained the wool, hides, and tallow that figure so largely amongst Russian exports. Beeves roam over the Sarmatian government of the Ukraine in huge herds, whence came, it is generally believed, the cattle disease, from which our dairies suffered so terribly: innumerable horses likewise abound.

The central territory is covered with forests. Woods stretch from St. Petersburg to Moscow almost without a single break, and it was a saying that a squirrel might pass from the one city to the other without touching the ground. The largest forests in Europe are round the sources of the Volga. The government of Perm has but an eighteenth of its soil uncovered by trees. Limes abound; but beech, oak, elm, maple, ash, willow, alder, and other trees are represented; while, towards the north, the growth of birch and pine prevails over all the rest. Immense herds of swine range these forests, which also harbour the bear and wolf. The peasants, who, till the present Emperor's reign, were serfs of the great proprietors, and sold with the estates, have always been allowed a pecuniary interest in the herds of swine, saving the bristles for itinerant merchants, and feeding upon the flesh. The freedom granted them by the Emperor Alexander will, no doubt, stimulate their industry and thrift, and lead them on in the path of civilisation. Bees in the same districts feed upon the multitude of wild summer flowers blooming in every open part, and build

Hosted by Google

their hives in hollow trees. Prodigious quantities of honey and wax are produced, many Russians having thousands of hives, the care of which is their chief vocation.

Timber is the bulkiest, as well as one of the most valuable constituents of the raw produce of Russia, but it is far from being the only wealth of the forest. Tar, pitch, resin, turpentine, spruce beer, potash, are all useful commodities, and wood for fuel, in a climate so rigorous in winter, is invaluable.

Minerals.—Iron is obtained from the Valdai Hills; copper in the hills to the north of Lake Onega; marble from Finland, and salt from the saline lakes in the south-east. The precious metals, including platinum, are found in the Urals, but on the Asiatic slope. The mineral wealth of Russia is, thus, chiefly in the coldest parts of the climatic zone.

Barley, oats, and rye, with favourable aspects, mature as far north as lat. 70°, and are used as descriptives of the next climatic division of Europe; that is to say—

The Zone of Northern Grains.

The limit of wheat growth is the northern boundary of the zone we have been studying. Wheat struggles to maintain its supremacy, but with an ever feebler force, as it penetrates the higher latitudes. It succumbs in the British Islands at the level of the sea, at 58°. In Norway wheat ripens at Drontheim in lat. 64°; the limit descending thence to St. Petersburg in lat. 60°, and still further south in the Russian interior.

This region severs the north Scottish highlands from Great Britain, takes in the greater part of the Norse peninsula, and, in an irregular line, crosses Russia to the Urals. The southern limits are comparatively mild; the northern limits are perpetually frozen; and the chill shade deepens in passing from the one to the other extreme. An Arctic vegetation is all that the Scotch hills possess, although the Gulf Stream keeps the western channels free

Hosted by Google

from frost. Norway enjoys the like immunities; its inlets and fiords, from the Naze to North Cape, are clear of ice, and vessels can steer round Margeröe all the year. Yet on the mountain ridge, a little distance inland, the snow line descends to the lowest elevations, and glaciers glide to the very verge of the frozen Baltic.

Arctic Russia.—The shores of Arctic Russia shelve, cliffless, down to the ocean, descending like the snowdrift direct into the water. Without a rampart from the polar blasts, there is an intensity of cold in these lowlands not counterbalanced by genial winds.

The Baltic.—The shallow and tideless Baltic has scarcely a sounding that could submerge St. Paul's Cathedral, and the pine-trees around would show their crowns if planted in any other part of it than the Gulf of Bothnia. Its navigation is impeded by shoals and banks. Being nearly landlocked, it is little affected by the ocean, and is fed only with fresh water. Open also to the polar winds that freeze the many lakes of Finland, the Baltic becomes in winter a solid highway between Russia and Sweden for sledges, and traffickers with their merchandise poised on their heads. Merchantmen are ice-bound before Cronstadt; the morass upon which the Russian capital is built feels the rigour of months of frost. Famished with hunger, the wolves leave their lair, making night hideous, and filling the droschky drivers' hearts with fear.

Lapland and Finmark.—The ungainly reindeer turns up the Lapland snow for the "moss" or lichen, which, by Nature's provision, is longest and most profuse in winter, when other food cannot be got, and thrives upon such scanty pasturage. The rich Laplander counts his patriarchal wealth in reindeer, often owning a thousand, just as at the other extreme of climate the Arab numbers his wealth in camels. The reindeer, like the camel, combines, in the service of man, the whole range of usefulness of our domestic quadrupeds. Where the ox, sheep, and horse would perish

Hosted by Google

from the climate and want of sustenance, these representative creatures give their flesh and milk for food, their skin for clothing, while they are patient beasts of burden, and satisfy numberless human wants.

Winter, in the greater part of this zone, lasts for nine months in the year, coming suddenly, without autumnal preparation, and breaking forth into summer without the intervention of spring, when, says the proverb, "a man may *hear* the grass grow." As soon as the cheerless season has passed, the snows melt on the Norwegian hills; cataracts take their headlong leaps and flash their surcharged waters into winding inlets, eager to join the ocean; the swollen streams burst with the force of a deluge, and devastate the lowlands lying between.

Forests.—Only at this season are the rivers full enough to carry to the sea the burden of timber, the great constituent of Scandinavian wealth. In many places transit cannot be accomplished, and the forests, in their lonely solemnity, unmolested by man, breathe forth the mournful wail peculiar to the pine tribe.

Sea-fowl.—Innumerable sea-fowl skim the surf or sweep the sky. Responding to their instincts, they line their nests with down, of the thick undergrowth of which they are twice rifled by the daring fowler. The fiords of Norway, the Baltic coasts of Bothnia, the polar shores of Russia, and the islands of the Arctic Ocean are alive with sea-fowl. Besides affording the luxury of eider coverlets and beds of elastic down, their flesh is useful, where so much else is denied, and their quills are a constituent of commercial wealth, of which Riga is the chief depôt.

Fisheries.—A teeming world of aquatic life exceeds in number, if not in interest, the feathered one. The species are few, but the individuals—as is distinctive of the polar zones—are numerous beyond computation. Fishermen haunt every fiord as well as the open sea, capturing millions of cod and other fish, which they salt for markets as distant

Hosted by Google

as Spain and the Mediterranean, and the streams are tenanted with salmon. Fishing and fowling are the sole maintenance of the granite group of the Lofoden Isles, to the great cod fishery of which men resort from all parts of Norway. Billingsgate relies upon Norway chiefly for its daily stock of lobsters, the consignments reaching the annual value of £100,000. Fish-oils, for the purposes of illumination as well as for food, are sought from the seal, and from a kind of shark, the liver of which, containing several gallons of clear oil, is the only part regarded.

Revival of Industry.—As summer advances, the whirr of many water-mills blends with the roar of the floods, and industrial sounds reverberate. The mining districts are animated with busy labour, Swedish, Laplandish, Finnish, and Russian. Emphatically, the husbandman "works while it is called day." Stockholm, the Swedish Venice, glistens in the waters of the archipelago upon which it is founded, and merchandise, unlocked from its icy moorings, gives life again to the Neva.

Grass grows on every patch of soil, and flowers gladden the ground suddenly, as if touched by a fairy wand. Larks and nightingales make the sky echo with song. Barley, oats, and rye may be measured in their daily growth. They are in seed, blade, and ear, ripened and reaped, within the brief three months' summer. In this short season, the niggard plains of Lapland produce corn, and potatoes, and butter, for export to Sweden.

An arch of liquid blue, dashed with tufts and patches of pearly vapour outdazzling the sea-foam, with a procession of clouds, tinted by sunbeams, scudding beneath, is Nature's glorified canopy. Each day the sun remains longer above the horizon, and each night's dispersion of heat grows less. The lengthened day accumulates heat, and tempts out the gnat-like insects; the reindeer is punctured with the stings of the gad-fly; midsummer comes before the first summer

Hosted by Google

greetings are over, and then, in the farthest north, the sun sets and rises without leaving the horizon.

Gradations in the Fauna and Flora.

Fauna.—Interesting gradations in the fauna and flora are observable through the zone. Animals being limited by the prevalence of their food, it is only in the lower and milder latitudes that the common domestic cattle are found. The deer is stalked in the hills of Scotland, and the elk in Sweden. The wild ox is rare even in Russia. The bison or auroch is now almost, if not exclusively, confined to the forest of Bialowikza, in Lithuania. Excepting reindeer, the animals, beyond the confines of wheat, are almost exclusively flesh-eaters. Bears are not fastidious in their diet, but the polar species is wholly a beast of prey. Nature, however, indulgent in her harshest moods, adapts the beaver, sable, ermine, and fox to an abode amongst the snows, and offers their thick and warm furs as a compensation to man for braving the bitterness of a polar winter.

Flora.—The most northerly point to which wheat reaches is 64°; rye, oats, and barley ripen as far as 69° or 70°. The potato and green vegetables grow at North Cape in about the same latitude, but only in lower latitudes inland. Berry fruits, such as cranberries—of which many casks are exported from Russia—strawberries, bilberries, and currants, enhance their flavour in this zone to an excellence unknown in England. Trees have a wide range, their vigour, however, being checked in approaching the pole. The beech and elm extend as far north as 60°. In Sweden and Norway the oak reaches 62°, and the lime, which in Russia forms the largest European forests, reaches 63°. The firs reach 68° N., the willow and birch slightly beyond the potato limit. These high latitudes, nevertheless, are attained only in the parts influenced by the Gulf Stream. Inland, owing to the greater cold, the limit falls short by five or six degrees of latitude. The birch, at the Isle of Hammerfest, does not exceed the height of a man, and at the extreme

Hosted by Google

limits, half-a-dozen full-grown trees of the dwarf species could stand, it is said, on an octavo page. Coniferous trees retain their energy beyond the normal range of the leaf-shedders, and are amongst the last to disappear. Local physical amenities, however, occasionally reproduce examples of these trees, so that the birch, mountain ash, and Scotch fir are not finally arrested before reaching latitude 78° N. At Umbar, six leagues east of Turu, there are forests of birch and spruce, the trees attaining a height of twenty-five feet, and a girth of two feet. Beyond the limit of trees, vegetation dwindles down to ground berries, saxifrages, and flowerless plants; still a few mosses, lichens, and grasses struggle for existence as near to the pole as explorers have been able to penetrate.

Hosted by Google

CHAPTER X.

ASIA: CLIMATE, SOIL, RAW PRODUCE.

General Description—Climate—Mineral, Animal, and Vegetable Produce—Plants peculiar to Africa and Asia.

EUROPE and Asia are strictly but one continent, lying mostly in the same latitudes, and having many features in common. While, however, Europe barely trenches on the region of palms, Asia extends through the sub-tropical zone, and has one-seventh of its surface within the tropics. Compared with Europe again, the climate of Asia is colder than the latitude would indicate; the line of permanently frozen subsoil descending in the coldest parts of the interior to latitude 50°, which is 20° farther south than on the west coast of Europe. Similarly, the limits of cultivation of the useful plants, by which we divided Europe into botanical zones, are modified in Asia, yielding to the tendency to descend. The vine, which flourishes at 50° in inland parts of Europe, nowhere ripens beyond 45° in Asia, its native soil, where the wild grape is a common plant; and sinks to 35° on the Pacific coast. The region of palms, which includes Sicily in the west, slants southwards at Canton to the Tropic of Cancer. Bearing this tendency in mind, we may trace the zones and sub-zones of growth, descriptive of Europe, across the continent of Asia, allowing for a variable southward deflection of from five to ten degrees of latitude.

The climate of the northern, eastern, and central parts is subject to great extremes of heat and cold in the summer and winter respectively; but only in the east and in the islands can it be described as variable. It is very dry and cold in the north, and upon the central table-lands; but hot

Hosted by Google

and humid in the south, where there are only wet and dry seasons, without any winter.

Various causes produce the peculiarities of temperature thus adverted to. The magnitude of the surface of Asia gives it a true continental as contrasted with an insular climate. The land absorbs and radiates heat more readily than the ocean. In summer, therefore, the spacious table-lands and plains of Asia accumulate a vast store of heat which they give off again in winter, and between the two extremes there is a great range unqualified by any of the equalising influences of the sea. The approximation of the land to the pole is another cause of low temperature. The flatness of the northern regions interposes no barrier to the cold blasts from the icy ocean, while the Himalaya range and its adjuncts effectually shut out the hot and the moist winds of the tropics. One result of the dryness of the northern atmosphere is that the snow-line of the Himalayas is 3,000 feet higher on the northern slope than on the southern counter-slope. The district of the greatest cold is in Siberia, where a mean winter temperature of 40° below zero is met with on either side of the lower course of the Lena, from Yakoutsk to the sea. The district of the greatest heat is in Arabia, where a mean annual temperature over 90° is met with on either side of the Tropic of Cancer, extending across the Red Sea and Nubia into the interior of Africa. Thus in every way, Asia is the continent of extremes. The cold of Siberia is so intense and permanent in its effects that the greatest heat of summer cannot thaw more than four or five feet of the soil. As an example of climatic extremes, we may take China. Pekin, the capital, in about the latitude of Naples, has an Egyptian summer and a Russian winter; and the summer of Canton, in the south, is hotter than that of India, being less favoured with sea breezes, and less elevated.

"Nature," says Malte Brun, "has given to each of these regions a physical character, which human industry will

Hosted by Google

never succeed in changing, or even in modifying in a sensible degree. As long as the present equilibrium of the globe shall continue, the ice will pile itself up in the mouths of the Obi and Lena; the winds will whistle in the deserts of Shamo, and Thibet will not see the snows of its Alps disappear before the rays of the sun, which at so little a distance scorches the tropical regions. Thus the Tartar is called to the agricultural and pastoral life, as the Siberian is to the chase. India, in appearance more fortunate, owes in great part to its climate that effeminacy, that indolence, which invites foreign robbers and domestic tyranny."

Soil.—South of the Himalaya range, and in China, the soil may be described as very fertile. In the north, steppes, and tundras or frozen bogs, prevail. Much of the central table-land, and the countries in the same line, are deserts, generally saline. In fact, the great desert region of the world, unbroken except by fertile strips of soil near rivers, such as the Tigris and Euphrates, or by a mountain chain, may be traced from the Atlantic, on the western coast of Africa, nearly to the Pacific, on the east of Asia.

PRODUCE: MINERAL, ANIMAL, VEGETABLE.

The expanse of Asia is so vast that every geological condition is represented, and consequently minerals of every kind are found. Diamonds and other precious stones are found in Hindostan and Siberia, whence have come almost all the world-famed jewels. Borneo and the East India islands produce precious stones. Borneo also exports large quantities of antimony. Gold is found in Siberia, India, the Chinese empire, and Japan. Silver is found in the same countries, and in the Turkish dominions. Siberia also produces platinum. Tin is obtained in large quantities from the Malayan peninsula, and from the islands to the south of it, and is also met with in China. Copper, iron, and lead are found in many parts. Quicksilver is obtained in Japan, the Chinese empire, and in Ceylon. Coal is

Hosted by Google

GENERAL LIBRARY University of MICHIGAN

worked in China and Hindostan, and exists, as yet unworked, in adjacent territory. Salt is the common product of most parts of Asia, though scarce in some countries; in the interior of Hindostan it becomes one of the chief commodities imported. Graphite is mined in Siberia.

Animal Produce.

In Asia is the probable centre whence came our domestic animals, all of which are represented in the several faunal zones. Besides these, there are domestic animals which have not become diffused through Europe. Thus, in the desert regions, the horse is displaced for draught by the camel, an animal so early subjugated to the use of man, that human history fails to go back to a time when wild camels were still known. The elephant succeeds in the south and south-east, where the large quantity of rich succulent vegetable food required by this enormous beast abounds. The one-hunched Arabian camel, or dromedary, ranges across Africa, Arabia, Persia, to the great central table-lands. The two-hunched or Bactrian camel then takes its place, and extends as far north as the latitude of 50°. The Siberian reindeer, on the other hand, descends from the north as low as the same latitude, and the representatives of the hottest and coldest climes meet along this line. The stock of elephants is constantly recruited by snaring and taming wild ones, the tame animals seldom breeding while in subjection. Horses abound over these parts, but the domesticated varieties are almost solely used for riding and war. The ass of Asia is a beautiful animal, chiefly found in the south-west countries, both in a wild state and reclaimed. The Brahmin ox is a sacred animal amongst the Hindoos, and treated with scrupulous reverence. The Angora goat of Asia Minor and the Thibet goat are celebrated for their long and silky hair. The pig is favoured by the Chinese, but is abominated as unclean in the Mahommedan parts of Asia. Wild horses, cattle, sheep, asses, and elephants live in herds or flocks, and furnish the kips or small hides, the skins, wool.

Hosted by Google

horn, and ivory so largely exported. Other animals never yet subjugated are still productive of many useful commodities. Such are the lion, tiger, leopard, jackal, wolf, and bear, whose skins are highly valued; and various kinds of deer and antelopes, the prey of packs of wolves and jackals, or of the solitary lion and tiger. The fur-bearing animals and other carnivora of the northern plains correspond very closely with those of Europe in the same zone, and are as eagerly trapped for the sake of their costly skins.

The names of our common fowls point to Asia as the centre whence they were diffused. The Bantam variety has been long known in our country for its courage and fighting propensities. The Cochin-China fowl has been introduced into Europe during the present generation. South-eastern and Further India abound with the wild stock of all our pheasant tribe. There are few warblers in Asia, and the range of the nightingale ends in Persia; but the plumage of many birds is unequalled. The feathers of the gold, and silver pheasant, of the peacock, and of the ostrich of Arabia, are of great value for dress and decoration. Parrots are also very numerous.

Porcelainous and nacreous shells of every variety of size and beauty are found on the varied shores of Asia, suitable for ornament, for cameo-cutting, and for the manufacture of mother-of-pearl. Of the pearl oysters, properly so called, none have been so long notable as those dived for along the Cingalese and Coromandel coast. There are less productive pearl fisheries in the Persian Gulf and the Red Sea.

Vegetable Produce.

The same physical causes that give variety to animal life in Asia, influence in like manner the vegetable produce. The floral zones are less irregular than the faunal, for while animals are limited in their range by the prevalence of food, or by their special adaptations, their capacity for locomotion gives them a power of widening or modifying their range, not possessed by plants.

Hosted by Google

The flora of Asia consists, in the first place, of plants indigenous to the continent, but now also diffused through other parts of the world; in the second place, of indigenous plants not yet diffused; in the third place, of plants which have spread by nature, or have been introduced by man. Viewing the flora as a whole, we may say that Asia has given much and received little. It is the native home of most of our useful plants, as well as of our animals. Its flora and fauna are now the most exuberant, both in number and kind, on the surface of the earth, and its kingdoms are the most densely peopled. The conditions of life are here fully developed, excepting in the northern plains, on the central table-land, and in the deserts, where climate and soil allow but little growth either of trees or plants.

European fruits are mostly of Asiatic origin. The vine, olive, orange, lemon, cherry, almond, walnut, peach, and fig, still grow wild in the wine and olive zone of this continent; the olive principally west of Hindostan, the vine in great perfection in Turkey and Persia, and ranging across to China. The pine-apple is so common in India as to be almost valueless.

Of our flowers, the China aster and Chinese primrose, with a whole host of recent introductions bearing the specific name of *Japonica*, or Japanese, tell their own origin. The camellia, damask rose, hydrangea, chrysanthemum, weeping willow, and many others of our choicest flowers and ornamental trees, have been brought from China and other Asiatic districts.

Of grain common to Europe, Asia produces in its corresponding zones, rice and maize, wheat, millet, and barley; with oats and rye in smaller proportion. Rice, barley, millet, and rye are probably indigenous. The vegetation of Siberia and Mantchooria is the same as that of the like parts of Russia in Europe.

It is, however, in the sub-tropical and tropical countries that the flora of Asia is exhibited in its fulness of power and

Hosted by Google

beauty. Botanically this is the region of palms, the northern boundary of which sweeps, with local circumstances of climate, across the Old World, from about 25° to 40° of north latitude, touching Europe only in the extreme south of Spain, Italy, and the Morea. The whole region of palms is a band of an irregular breadth, being 40° wide in its narrowest part, and 70° in the widest part, and is situated pretty equally on each side of the equator. It takes in the whole of Africa, with the exception of Cape Colony, and the northern half of Australia. These boundaries are nearly conterminous with the limits of rice growth, and are circumscribed, at a mean distance of about 5° north and south, by the limits of vine culture.

It will be convenient at this point to include Africa in our survey of the zone, the description being necessarily applicable in many particulars to the two continents.

AFRICA AND SOUTHERN ASIA.

Of the many species of palms, the date and the cocoa-nut palm are the most distinctive. The date-palm ranges across the deserts of Africa and Asia, from the Atlantic to the Himalayas. The district of cocoa-nuts is from Ceylon eastwards to the Pacific, this palm loving the neighbourhood of the sea. The date is the principal food of the roving desert tribes, who wonder how people can live elsewhere without it. Rice is the chief food of the densely-peopled countries of India and China. The sugar-cane is cultivated in Africa as well as in Asia, and coffee, now so extensively grown in Arabia and India, is supposed to have spread from Abyssinia. The distinctive fruits of the wine and oil countries, oranges, peaches, pine-apples, figs, and almonds, range also through the region of palms. Palm-oil is produced exclusively in Africa, and correspondingly, cocoa-nut oil is obtained in Ceylon.

Teak and other timber trees are common to both continents, and cotton is a universal product, every part of the zone proving its capability of cotton growth during the

Hosted by Google

American war, when our supplies from the United States were stopped. The area of supply expanded so rapidly that our importations when at the lowest amounted to 300,000,000 lbs. The accidental stimulus to production being removed by peace, the reaction has been violent, and supplies have sunk to zero in many promising places, as rapidly as they are recovering former dimensions in the Southern States. Egyptian cotton is of fine quality, and in India there is not a spot but produces one or another variety. China, too, has been noted, time out of mind, for a buff-coloured staple called nankeen.

The animals of Africa are akin to those of Asia, but very few of them have been tamed. Of useful animal products, a description has been given in connection with the British settlements and colonies in Africa, to which may be added silk, which connects Europe, Asia, Africa, and Australia. All the silk countries still rely upon China and Japan—whence the silkworm first came—for their supplies of grain or seed, as the eggs are called, in which a large trade is carried on.

Plants peculiar to Asia.—Some of the most esteemed woods for cabinet-making, as rose-wood, satin-wood, sandal-wood, and ebony, come from Further India. The sago, areca, and other varieties of palm, are characteristic of particular districts. Many gums, resins, balsams, and drugs are still only obtained from Asia. The most peculiar plants are, however, limited by nature to a narrow area of cultivation, from which they cannot be removed without destruction, or the loss of their principal properties. Such are the spices and tea. Several of the spices flourish nowhere so well as in their small indigenous centre. It is a natural law that when a plant is transferred to another centre it will develop new qualities, oftentimes improved qualities; but in the case of these spices, transference has always ended in death or deterioration. China almost engrosses the production of tea, though the shrub is also indigenous to Assam and

Hosted by Google

the Eastern Himalayas, where efforts have long been making, with partial success, to encourage its growth. Japan, too, cultivates tea, and has opened its ports to the trade. It has been introduced into Australia. Nevertheless, the true tea-growing district is so little affected that our dependence may still be described as altogether on China.

Plants introduced into Asia.—The only plants of importance which Asia owes to other parts of the world are maize and tobacco, both from America. Tobacco, which was unknown in the Old World till brought from America, is a remarkable example of the diffusion of plants. Its growth is now nearly universal through a zone between 80° and 90° wide in both the New and the Old World, and its consumption is general over the whole earth. Some of the choicest growths are obtained from Asia, such as that of Turkey and of Manilla. Various species of *Cinchona* of South America yielding Peruvian bark are also instances of the transference of important plants to Asia.

Southern Boundary of Vine Growth.—The southern limit of the region in which the vine would flourish for vintage is in a higher latitude than the limit of palms, and can be only marked upon the ocean. It runs nearly parallel with latitude 40° S., and the isothermal line of 60° mean annual temperature, deflecting about 10° south near Australia, and thereby comprising Tasmania and New Zealand.

The limits of wheat and northern grains are without analogues in the south, inasmuch as no part of the Old World extends to such high latitudes as 50° or 60° south.

Hosted by Google

CHAPTER XI.

THE NEW WORLD: NORTH, CENTRAL, AND SOUTH AMERICA.

Climate—Temperatures of Old and New World compared—Soil—Raw Produce, Animal, Vegetable, and Mineral.

Climate.—A survey of any good map suffices to show that the New World must, of necessity, differ materially in climate from the Old World in corresponding latitudes. Its chief mountain ridge runs north and south, or nearly at right angles to the mountain ridge of the Old World. The counter-slope of this ridge is narrow; consisting in South America of a long strip of coast, descending precipitously towards the Pacific Ocean. The great expanse, therefore, of the continent, is eastward, towards the Atlantic. This difference of direction between the two continents is very remarkable.

Although the New World stretches through every zone, yet its average temperature, compared with that of the Old World, is lower. The Pacific, or western coast, is warmer generally than the Atlantic or eastern coast, corresponding, in this respect, with the western and eastern boundaries respectively of the Old World. These variations and resemblances are approximately marked by the floral zones, as summarised in the following table (see p. 106).

If we connect the corresponding points of the two hemispheres by lines across the Atlantic and Pacific Oceans, we complete the botanical belts encircling the world. We also see that the Arctic vegetation has no analogue in the southern hemisphere, the land not extending, with the exception of Patagonia, even to the limit of wheat, and

Hosted by Google

thus falling far short of the limit of hardier grains and of trees.

BOTANICAL REGION.	NEW WORLD.		OLD WORLD.	
	West Coast.	East Coast.	West Coast.	East Coast.
Approximate Northern limit of Trees.	N.L. 64°	58°	71°	63°
Southern „ Trees.	S.L. —	—	—	—
Northern „ Grain.	N.L. 60	50	69	60
Southern „ Grain.	S L. —	—	—	—
Northern „ Wheat.	N.L. 51	48	64	50
Southern „ Wheat.	S.L. 45	42	—	—
Northern „ Vine.	N.L. 40	40	45	40
Southern „ Vine.	S.L. 34	36	35	38
Northern „ Rice.	N.L. —	32	42	45
Southern „ Rice.	S.L. —	25	25	—
Northern „ Palms.	N.L. 27	36	35	30
Southern „ Palms.	S.L. 34	35	32	32

NORTH AMERICA.

We may infer from the contour and vertical relief of North America many of its climatic features.

(1.) The land is broadest in the north, where it expands to embrace the pole, and at the same time lies so low as to interpose no barrier to the Arctic blasts, which sweep down from the north. (2.) The tropical lands taper to an isthmus; there is, therefore, but a small part of the continent in the torrid zone, and even this is mountainous. (3.) The west coast consists of mountains and table-lands, which prevent the warm and humid winds of the Pacific from crossing the country; while the minor Appalachian ridge, on the eastern side, completes a broad valley for the Mississippi—the uninterrupted channel for the northern winds from the pole to the Gulf of Mexico. We see, in consequence, that the central lowlands must be the coldest part of North America—a fact marked upon the map by the deflection of the isothermal lines.

One further element of climate must be taken into

Hosted by Google

account—that of the marine currents. The Pacific currents, not so well investigated as those of the Atlantic, contribute from their direction to raise the temperature of the western coast. The Atlantic currents have already been considered in relation to the climate of Europe. Let us now trace their influence upon the climate of America. The source of the Gulf Stream is in the Gulf of Mexico, where the heated waters, instead of giving life and health as they do to our own country, increase the pestilential nature of the swamps of the Mississippi delta and the Florida shores. At Cape Hatteras, the Gulf stream curves away from America in a north-east direction across the Atlantic. The ameliorating powers of the current are thus carried away from the continent where it originated, and in its room, Arctic counter-currents sweep along the east shores of Greenland and down Baffin's Bay. These cold currents united, stream along the American shores, rendering the neighbouring lands hopelessly barren, almost to the 45th degree of latitude. Such is the force of the Arctic counter-current that it brings the icebergs, formed from the Greenland glaciers, southwards to the Gulf Stream, where the denser and colder waters sink below the warm flood, still driving the icebergs onward in opposition to the surface flow, till the higher temperature dismantles their pinnacles, and dissolves their masses. Thus are created the almost perpetual fogs of Newfoundland. The limit of icebergs in the Atlantic is about 45°, the latitude reached in Europe by the vine. Inland, two or three degrees farther north—on the same parallel with Brittany and Normandy—the ground is covered with snow for more than half the year; and beyond 50° —a latitude which London exceeds by nearly two degrees—there is scarcely any cultivation. The vast forests of the American plains tend also to lower the temperature by intercepting the sun's rays, and thus preventing absorption of its heat. The enormous clearings, on the other hand, have already sensibly modified the climate.

Hosted by Google

Nevertheless, the summers of North America are hot. Its climate is essentially extreme, both from the extensive range of territory, and also from its being shut out by the mountains from the equalising ocean winds. Only the table-lands and mountains of the west are exceptional. The Mexican table-land enjoys continual spring, the causes of which are easily seen. The isthmus connecting the north and south continents exhibits every phase of climate in vertical zones, from the almost unendurable tropical heat at the base to Arctic elevations and the line of perpetual snow.

SOUTH AMERICA.

The bulk of South America is tropical, and its southern part diminishes in breadth rapidly on approaching the pole. The climate of South America is, therefore, latitude for latitude, of a higher temperature than that of North America. The table-land of Quito (9,000 feet), like that of Mexico, is ever vernal, and the Andes of the equator range through all the vertical zones of vegetation. The region of Patagonia, riverless and hilly, is dry, cold, and barren.

Soil.—The New World is pre-eminently the country of great plains, through which flow the longest rivers in the world. These plains, except where physical conditions evidently forbid, such as in the Arctic lowlands, are generally fertile, the river valleys being exceedingly so, and in particular, the basins of the Mississippi and the Amazon. Parts of the plains, both north and south, are barren, and sometimes salt, but there are no *deserts* to compare with those of Africa or Asia. Quite a fourth of the soil is reckoned as unproductive.

The great central plain of North America is divided by a watershed 1,000 to 1,500 feet high, in latitude 49°. into the Mackenzie and the Mississippi lowlands. The Mackenzie lowlands form a very gentle declivity consisting of swampy and frozen marshes. The Mississippi lowlands comprise the prairies (the French name for meadows) and savannas (from the Spanish *sabana*, a sheet). These plains

Hosted by Google

are treeless but fertile, the prairie grass growing upon them to the height of ten or twelve feet, and covering spaces to the eye like limitless seas of vegetation. Many thousands of square miles of the same lowlands are covered by the forests or backwoods of North America, and the whole plain, from the Arctic Ocean to the Gulf of Mexico, exceeds Europe in size.

There are three distinctive river plains in South America. —1. The *Llanos* (Spanish, level fields) or plains of the Orinoco. These are grassy flats, covering 150,000 square miles, between the equator and 10° north latitude. So level are the llanos that, at 500 miles from the ocean, the ascent generally is not more than 200 feet. The greater part of the region is inundated in the wet season, to which is due its peculiar character. As the water disappears in the dry season, it is followed by a rapid growth of grass, which in turn becomes parched and very combustible, and conflagrations occur over thousands of miles.

Humboldt speaks of these terrestrial expanses as more awe-inspiring than the highest mountains. There is nothing in the landscape to soften the feelings of sadness and gloom, where everything seems silent and motionless, and during thirty days' journey the plain appears to ascend to the sky, and the vast and profound solitude looks like an ocean covered with sea-weeds.

2. The *Selvas* (Latin *silva*, Spanish *selva*, a wood).—The selvas or woody plains of the Amazon, cover nearly the whole drainage area of that river, an extent of 2,000,000 square miles. The selvas are the largest forests in the world. Favoured with abundant moisture and tropical heat, the trees attain dimensions rarely seen elsewhere, their height reaching generally from one hundred to two hundred feet. The rankest profusion of climbing plants, which are the growth of a soil the rich produce of centuries of vegetable decay, twine round the trunks to the top, and, reaching over, interlace the trees, and, combined with the thick under-

Hosted by Google

growth, constitute a wall of vegetation impregnable except to the constant strokes of the hatchet.

3. The *Pampas* is the native name for the treeless plains of the basin of La Plata. They are covered with grass where watered by the affluents of that river, but arid and withered out of reach of these streams. There are, however, extensive tracts of a different character. In the north-west thistles and other prickly plants take the place of grass, and grow of amazing magnitude and number. There are also sandy and saline deserts. *Las Salinas*, a salt desert in the north, is 30,000 square miles in extent. Near the Andes the plains become boggy.

Mineral Produce.

The geological structure of America is eminently favourable for mineral deposits. The whole length of the great mountain ridge, from the British territories in the north to the point where the Andes leave the mainland, and form the Patagonian archipelago, is more or less metalliferous. The same may be said of the hilly parts of Canada, and also of the Alleghany region of the United States, but not of the West Indies. Besides the Andes, properly so called, the adjoining territory of Venezuela is rich in metals, as are likewise the mountainous parts of Brazil. The minerals of South America are more restricted as to locality than those of North America; the immense woody plains of the Amazon, without a hill and without stone or mineral, separate the western metalliferous regions from the eastern. They consist especially of gold and silver, which have been sought to the neglect of the common useful metals, although these last are probably more profitable to work.

NORTH AMERICA.

Gold, silver, tin, quicksilver, copper, lead, and iron are found in North America. Mexico is rich in gold, the gold-bearing strata extending southward into Central America and northward into the richest gold-fields of the continent, those

Hosted by Google

of California. Gold is found in smaller quantities in the eastern States of the Union, chiefly within the high grounds of the Alleghanies or Appalachian region. Mexico alone produces silver, tin, and quicksilver. Mines of copper and lead exist in Mexico, the United States, and Canada. Iron is produced in the same countries, and also in Guatemala. Plumbago is abundant in Canada, and is found in the United States, where likewise a great quantity of zinc exists. The produce of the quicksilver mines of California surpasses that of all others, and regulates the price of this valuable metal in every market of the world. Its essential use in separating vein-gold from the quartz in which this last metal is embedded, has stimulated the working of the mines in recent years.

Next to the metals, the chief mineral produce is coal. The coal-fields of the United States are the largest known, embracing an area more than double that of Great Britain. These immense deposits lie chiefly within the western slopes of the Alleghany region—Western Pennsylvania, Ohio, and Virginia West—in the peninsular tract of country between the great lake basins of Michigan, Huron, and Erie (state of Michigan), and in the region extending across the lower Missouri and Arkansas rivers, including the diversified tract of the Ozark mountains. These vast stores of coal are, however, but little worked, and the produce of the United States is less than a sixth of that of Great Britain, and hardly exceeds the yield of the little kingdom of Belgium.

In Canada the vast Laurentian and Silurian deposits forming the chief part of the river valley of the St. Lawrence oppose the occurrence of coal, but New Brunswick and Nova Scotia, both now included in Canada, have workable coal-fields. On the other side of the continent, coal of excellent quality is procured in the adjacent Vancouver's Island, and is wrought to a considerable extent.

If wanting in coal, Canada has other rich mineral resources. The shores of Lakes Huron and Superior yield abundance of copper, and possess, besides, ores of zinc, lead,

Hosted by Google

&c., and plumbago; petroleum or mineral oil, obtained recently in enormous quantities from the carboniferous area of the United States, and from that portion of Upper Canada lying between Lakes Huron and Erie, must be added to this brief survey of the New World.

Salt is common in many parts of the North American continent. Some fine specimens of marble are quarried in Canada, and in the United States, where also slate and asbestos are found.

WEST INDIES.

The rocks composing the larger and smaller islands differ respectively in their lithological character, and therefore in their mineral produce. In the small islands of volcanic origin, metallic lodes, or ores are rare. Porto Rico produces gold. Copper and iron are found in Cuba, and lead in Jamaica. Almost all the metals are believed to be represented in St. Domingo, together with coal, and numerous other minerals. Rock salt is now mined in Cuba.

SOUTH AMERICA.

The metals of South America are the same as those of North America, but only one lead mine—an argentiferous galena—has yet been discovered, that of Carupano, Venezuela. In Columbia is found the infusible and rare metal platinum, which is unknown in the northern continent. Peru is the principal metalliferous region; its produce being gold, silver, and copper, in common with other districts, and mercury and tin, peculiar to itself. Gold is supplied by Columbia, Venezuela, Brazil, Chili, and Bolivia; silver also by Chili and La Plata; copper from Chili, is sent to Swansea for smelting, although Chili has coal. Brazil produces iron and nitre abundantly, with immense quantities of salt.

The precious metals are thus seen to be the principal produce of the mines of South America. The mountains everywhere are metalliferous; but wasteful working, difficult transport, the deficiency of fuel, and the distracted state of

Hosted by Google

most of the mining regions, have combined to lessen the value of the mines. California produces more gold now than any other part of America. Gold and silver mines abound in the Andes. Chili produces more gold than silver; the former being found in every rock, and among the sands of its many mountain streams; but, generally, silver is most prevalent in the Andes, as gold is in the sierras of Mexico and California. The far-famed silver mine of Potosí, in Bolivia, has yielded—since its opening—in the three centuries a greater amount of silver than all the mines of Peru, and nearly half the value of the produce of all the mines of Mexico.

The gold of Brazil is extensively dispersed among its mountains, but the yield is small, and silver ore has not been met with. This country contains diamonds and other precious stones to a greater degree than any other; and, with Hindostan, Borneo, and South Africa, completes the list of places productive of the diamond.

Of common minerals, South America is deficient; nitre and salt, as already mentioned, being the chief products.

Animal Produce.—The indigenous fauna of America is more limited than that of the Old World, and especially so in the larger species of animals. Besides being few in number, and small in size, the mammals are mostly of peculiar structure. The llama was the only domestic animal found upon the continent by the first European settlers. In the northern regions, where America all but meets the Old World in the narrow breadth of Behring's Straits, the reindeer, the elk, the bear, the fox, the beaver, and the glutton, are common to both hemispheres. Hunting and trapping the fur-bearing animals has been hitherto the almost exclusive vocation of the sparse population of the Hudson's Bay territories. The marine mammals—the seal, the walrus, and the whale, which furnish us with skins, oil, whalebone, and ivory—are identical with those throughout the arctic and sub-arctic zones.

Hosted by Google

Further south, the American bison or buffalo, hunted for its tongue chiefly, overruns Canada and the Western States, herding in the prairies and savannas of the Mississippi river, where likewise deer are extremely numerous. Great flocks of the large-horned or wild mountain sheep live among the Rocky Mountains. Many of the quadrupeds of Mexico are peculiar to the country, but none of them are of any important economic value.

Birds are numerous and of many varieties. America is the native home of the turkey, two or three species of which are found in the forests of North and Central America. Tropical America has curassows, and guans, birds equally large, and as delicate of flesh. The other birds of use for food, or for industrial purposes, are closely related to those of the Old World. The arctic shores are covered with sea-fowl, as in Europe. The eagle and the vulture live in the mountains. Passenger pigeons darken the sky by the immensity of their numbers. The nandu of La Plata, and the rhea, a smaller bird of Patagonia, represent, in America, the ostrich, by which name, too, they are sometimes called.

Many of the American birds are valued only for the brilliancy of their colours. The delicate humming-birds range from Alaska southwards to Cape Horn. Beautiful parrots likewise have a large southerly range, though not extending more than a few degrees beyond the Tropic of Cancer. Amongst the American reptiles several are turned to useful account. Turtles abound in the enclosed seas of Central America, and upon the shores of the West Indian islands, affording one of the choicest forms of animal food; and also along the Pacific coast, where one species of turtle supplies the beautiful substance called tortoise-shell. An extraordinary fish-like reptile, caught only in the Mexican lakes, and called the *axolotl*, is eaten as an exceeding delicacy.

Edible fishes are abundant, both of the sea and the river species. Exhaustless shoals of cod feed on the banks

Hosted by Google

east of Cape Breton and of Newfoundland. Varieties of the herring also fill the inlets, and are caught in myriads.

Of minor food-products from the animal kingdom, oysters are so plentiful, that dinner in the United States is never complete without them in one or more fashions of cooking. Oyster banks, along the low mangrove swamps of the Southern States, form natural embankments against the sea. Along the shores of California, pearl oysters are found. In the class of insects, the cochineal is indigenous, and was brought from Mexico, whence we still get supplies, though small in comparison with the produce of the warm parts of Europe. Bees, introduced from Europe, supply, in return, large stores of honey.

It is not the native animal produce, but the produce of animals introduced by Europeans, that distinguishes America in the present day. The domestic varieties of Europe have found the conditions of increase so favourable, that horses, cattle, and swine have returned to a state of nature, and swarm over the boundless plains, or through the forests both of the North and the South. The Indians of the North, who have become fearless riders, hunt the bison on horseback. In tropical America the mule is used as a beast of burden, and the numbers of this sure-footed animal—a compromise between the beautiful Spanish wild ass and the horse—it is hardly possible to estimate.

With the knowledge of these resources, we are able to name the animal produce of which America will have a surplus for interchange. From our own possessions and the United States, cheese and provisions, as exports, increase in quality and quantity every year. Hides, tallow, and wool are also exported. Furs from the extreme north, and fish, both dried and pickled, to which we may add the produce of the whale fishery, are, and will remain, constituents of the grand commerce of North America.

South America, less advanced, sends us chinchilla furs from Venezuela, and hides, tallow, horsehair, horns, bones,

Hosted by Google

and wool from the animals that bound over the country between the llanos of the Orinoco and the shingly steppes of Patagonia. Means are being taken to export the flesh of the oxen in a fresh state to Europe, but the success as yet has been very partial.

Vegetable Produce.

The flora of a continent, the distinguishing physical features of which are vast lowlands, in temperate and tropical regions, amidst heat and moisture, may be determined beforehand as diversified and exuberant. In tropical America vegetation reaches its utmost limits of luxuriance. Nevertheless, before the introduction of plants from Europe, the productions of the continent were peculiar, and comparatively few of them known to be useful to man. As in the case of animals, America has given little and received much. The plants introduced have spread widely, and furnish limitless stores of food. Nearly all the economic plants of Europe are now grown in the cleared parts of the United States, and the tropical zone has been enriched with many plants from corresponding parts of Africa and Asia.

Indigenous Produce.—Maize is the only native representative of the cerealia; and manioc, from which cassava bread and tapioca are prepared, takes the place in South America that rice assumes in India. Allspice is the only important native pungent condiment, and is akin to the various spices of India. Cocoa and maté, or Paraguay tea, are the beverages of South America, in lieu of coffee and tea. Plantains and bananas are the characteristic fruits. Cinchona bark—from which the invaluable drug quinine is extracted—the ipecacuanha of Brazil, the sarsaparillas of tropical America, and the jalap of Mexico, have no representatives elsewhere. The most remarkable native products are, without doubt, first, the potato—spread from Chili throughout the world; secondly, tobacco—now grown in several countries, but brought to perfection only in its native soil of Cuba, the capital of which, Havannah, gives the name descriptive of the

Hosted by Google

best leaf. Although the indigenous plants used for food are few, compensation is given in the weight of their produce. In Europe, large spaces are covered with food-grasses and other plants, for the sustenance of the inhabitants. In America, small tracts of maize, manioc, and plantain will produce enough food for large numbers of people. As a consequence, in South and Central America, where these plants flourish, the country remains in its wild, natural state, even in the vicinity of large towns, the inhabitants not being obliged to extend their cultivation. The vigorous races of North America, however, cultivate wheat, barley, and oats, and the tropical rice, all of which, in their respective zones, flourish abundantly. Bread-fruit has been introduced, and pine-apples have become so plentiful that they grow in the fields in the West Indies as turnips with us: many shiploads reach our markets, in the season, at so moderate a cost as to bring this chief among choice fruits within the reach of the poor.

Coffee and sugar have proved their adaptation to the American tropics, the crops of both being enormous. The East Indian spices also grow in the West Indian Islands, although not in the same perfection. Cotton has found the foreign conditions of growth in America superior to those of its native soil, and its spread is almost beyond belief. The American crops transcend those of all the rest of the world.

Besides these vegetable products that appertain to food and clothing, America possesses peculiar forest growths. At the head of these we must place the mahogany tree, the beautiful colour and grain of which, as well as its durability, placed it on its discovery in the highest rank amongst cabinet timber. Logwood, quer-citron, and Nicaragua woods are well known as yielding valuable dyes.

The tendency to efflorescence in the trees of America, and the floral beauty of many of the shrubs and annuals have encouraged their diffusion through Europe. Our gardens owe to this source the grand flowering rhodo-

Hosted by Google

dendron and the magnolia. The American aloe and the cactus have found a congenial region round the Mediterranean, where they exhibit all their native vigour. The dahlia, fuchsia, nasturtium, and passion-flower, all had a western origin. Many other trees and plants, valued for their foliage or beauty of development, from the colder parts of America, where flowers are less profuse, adorn the parks and pleasure-grounds of Europe.

Vegetable Produce according to the Floral Zones.

Our previous knowledge of the zones, as applied to the Old World, combined with the general knowledge gained of the produce of the New World, prepares us for a brief description of this division of the subject.

The boreal region, or climate of mosses and berries, is like that of Lapland. The arborescent forms, at the extreme limit of the zone, are a few stunted birches, willows, and junipers; otherwise, the ground is covered with a thick growth of lichen and moss, which defies the cold and overpowers other vegetation. Towards the southern border extensive forests, which extend into the next climatic zone, characterise the country.

The region of European grain and forest trees is bounded southwards by the line of vine culture and the growth of maize. Canada and the northern United States are included within it. Peculiar species of oak, beech, and numerous other forest trees, orchard fruits and nuts, the cereals, including in the south, maize, the common fibres, and, to some extent, tobacco, all flourish in this zone; also woods of great value and beauty, the bird's-eye maple and the mast pine being the chief varieties, noted for the delicacy of their grain and texture. A peculiarity of the North American forests is that one description of tree prevails on each variety of soil, evidence of which is given in the descriptive names of oak lands, chestnut lands, pine barrens, and cypress swamps.

Hosted by Google

The sugar maple supplies from its sap most of the sugar used in Canada, and much of that used in the United States, and its produce might be indefinitely increased. Potash—principally from the beech—pitch, tar, resin, and turpentine, are forest products, in quantities corresponding with the endless sources of supply, but identical with those of Europe. Trenching on the warmer regions, the myrtle wax-tree (*Myrica cerifera*) abounds, and supplies in its seeds a dry and brittle wax, of excellent quality and large amount.

The region of wheat and tropical grains is productive also of maize and rice, the vine, citron, and melon, as in the Old World; but in reference solely to America, perhaps cotton and tobacco would be more descriptive of the zone.

The mountains of Mexico, separating that country from the rest of the region, and raising it on a table-land 7,000 to 9,000 feet above the sea, make it the botanical centre of a flora peculiarly its own, including the cochineal-cactus, and other plants. On the east, the Alleghanies separate the fertile valley of the Mississippi from the poorer soil and barren swamps lying between these mountains and the Atlantic shore.

The true tropical parts of America comprehend the central states, that is, Mexico, the republics of Central America, and two-thirds of the southern continent. All the useful food plants of India are diffused throughout this zone, besides a rich vegetation of its own. Tropical grains and manioc, ginger and other spices, coffee, sugar-cane, and sweet fruits, gourds and pine-apple, cocoa-nut and other palms, tree-ferns, tobacco, drugs, dyes, and timber are amongst the contributions that Central America offers for man's service. Tropical South America adds other gifts. The palms are in great variety. Besides the cocoa-palm, there are the cabbage, the fan, and the oil-palms, the coquilla and the vegetable ivory. Bread-fruit trees and cow-trees, producing milk, are numerous; and from allied

Hosted by Google

plants, characterised by their milky juices (*Euphorbiaceæ*) our chief supplies of caoutchouc are procured. Other products of an important nature, such as the cacao, indigenous to the country, have already been mentioned.

The flora of the Andes ranges vertically through every climatic zone, beginning with the plantains and palms at their torrid base, and passing through the intermediate phases of climate, to the silent and frozen mountain summits, devoid of life.

South of the Tropic of Capricorn the products of the torrid and temperate zones interfuse. No rice is seen, but maize grows with wheat and barley, and palms and the mulberry flourish together; tobacco, hemp, and flax ripen by the side of the melon, the lime, and the olive. Chili produces a surplus of wheat for exportation. Brazil is in many parts still covered with forests almost impenetrable. From them rosewood and dye-woods are obtained.

Beyond 40° south latitude there is little cultivation, and vegetation diminishes rapidly. The climate would admit of grain, but, except in a few parts, the soil is a shingly desert upon which little will grow that can be turned to any economic use. The peninsula tapers to a point which trends southwards to the latitude of 55°, and the last ten degrees are utterly cold and desolate.

Hosted by Google

CHAPTER XII.

NATURE AND MAN AS AGENTS OF CHANGE.

Summary of Former Chapters—Contrast of Old and New Worlds as to Physical Conditions—Geological Evidence of Change of Climate and Produce—Variations of Orbit—Man Subject to these Laws—Their Harmony Illustrated.

We have now traced the relation throughout the earth; (1) between geological conditions and mineral wealth; (2) between climate and soil on the one hand, and organic forms on the other. We have seen how contour, vertical relief, and other physical features modify climate and soil, and consequently animal and vegetable life. We have also been led to observe that the study of the geology of any region is auxiliary to a knowledge of its flora and fauna.

The great mountain ridge of the New World presents no such barrier between the equator and the poles, as the Himalayas and their adjuncts offer in the Old World. The dispersion of plants and animals is therefore limited by more elastic conditions, and the separation of zones is marked by less decided lines. The tropical waters of the Caribbean Sea divide America into a northern and southern continent, closely corresponding, each division being related to the other by bands of analogous climate and produce, which are but portions of bands similarly crossing the Old World, and encircling the earth.

There is abundant evidence to prove that the zones of the earth's surface have been subject to repeated changes, the agents of which have been Nature and, involuntarily, man. The great plains of America are geologically recent. In

Hosted by Google

the arctic regions coal-beds are found, the fossil flora of which, composed of a preponderance of Conifera, indicates a climate corresponding to that of mid-Europe, and proves that in the long cycles of the earth's physical history and its successive oscillations, the poles, whose frosts we often call eternal, have aforetime and more than once borne excess of heat.

The vibrations of the earth in reference to its axis, slow though they be, are persistent, and although intervals of thousands of years are required to make perceptible comparisons, yet the equilibrium of our planet goes through a long period of unresting poise. At the present time the arctic coasts are rising, and the bed of the Pacific is sinking in obedience, it is believed, to the law requiring the centre of gravity of the earth's mass to be maintained by the mobility of the ocean. The nature of the changes thus brought about may be illustrated by a supposition easy to comprehend. If the relation between America and the Atlantic were gradually to alter so that the sea-level rose 300 feet, the llanos of the Orinoco would be covered. If it were 1,100 the sea would wash the base of the Andes, and only leave those mountains and the highland of Venezuela, the Guianas, and Brazil above the waves.

Man finds work ever ready to his hand. By diligent labour, guided by intelligence, he can modify many of the aspects of Nature, and obtain from her bounty an indefinite increase of enjoyment. He cannot alter the past or arrest the future, but he may shape the issues of both to his advantage.

What are the limits of our power, and how may we best use it to promote well-being? Such are the inquiries which the course of study we have pursued should aid us to answer.

Nothing more beautifully shows the harmony of natural laws than the modifications of the forms of life by the change of conditions. We fell a forest, and the timid browsers lose

Hosted by Google

their shelter and food and disappear; the wild beast is deprived of its covert and prey, and is seen no more; birds, too, migrate to districts where insects and berries abound. We cultivate a plain, and the grub of the cockchafer begins its havoc among the corn roots, and the earthworm its system of under-tillage, till, attracted by their prevalence, the familiar forms of our common birds are seen, and the balance of vegetable and animal life is restored. The sparrow was unknown in Russia last century; but the rapid progress of corn culture, the sign of civilised progress, has emboldened this bird to spread over the empire, even as far as Siberia. Partridges, again, whose food is found in the corn-fields of England and France, have recognised the high husbandry of Scotland, and are met with at Inverness, the limit of British wheat growth. Food, therefore, becomes the link between the flora and fauna of the climatic zones.

Many illustrations might be submitted of the effects of human agency in modifying the aspects of nature, sometimes intentionally produced, sometimes otherwise. Mr. Grierson, at the meeting of the British Association in 1866, read a paper referring to the destruction of plantations at Drumlanrig in Dumfriesshire, by the voles, commonly called rats, which are the pest of Sweden. They appear to be migratory in their habits, and occasionally increase in myriads. From the recent slaughter of rapacious birds, such as owls, hawks, and eagles, which Nature has appointed to bound the unlimited fecundity of the rodentia, the voles have found a safe field for action. They principally destroy the young oak and ash, gnawing a ring of bark near the roots and beneath the grass, the trees being unable to resist such attacks until after at least twelve years' growth.

By our acquaintance with the *facies*, or landscape features, of a floral region we are able to judge when and where we can with profit introduce or transfer the plants of one country or hemisphere to another. Thus it is that we have spread the useful food plants, fruits, fibres, and timbers, or

Hosted by Google

strewn our colonies with wild flowers, associated with the thoughts of home.

The vegetable kingdom is full of striking examples. The fruits of Europe, mostly of Asiatic origin, were removed westward in the same zone, and subsequently to the New World. The diffusion has been carried still further into the zones of the southern hemisphere. The vine now flourishes in South Africa and Australia. Grains, either tropical or northern, have gone with man into every habitable clime. Maize has enlarged its area in the three continents of the East, and rice has spread almost as widely in the West. We owe to Chili the potato, which has lightened existence to extra millions of mankind. The pine-apple was a native of the Bahamas and Bermudas, and is now plentiful round the Mediterranean. Tobacco, unknown till the sixteenth century, belts both sides of the equator far beyond the tropics. Cloves and pepper are acclimated in each of the Indies, though native only to the East. Coffee also, indigenous to Arabia or Abyssinia, has sped through the tropical zone. Thus, also, with the fauna, we have aided Nature in the distribution of her productions, enriching each zone with the representative species of its corresponding zone. The wild horses and cattle of South America seem destined to exterminate the native llama. The English sheep in Australia have driven the kangaroo inland, and threaten its extinction. The effect of introducing our domestic animals into other countries has been to increase our resources for food and clothing, to add to wealth, and to the duration of human life.

Nature has arranged the climatic zones in a manner whose simplicity and unity of working fill our minds with an exalted pleasure. Oceans come between the continents, and obstruct the passage of certain forms of life; yet many thousands of miles distant the conditions of being are only modified, and we meet, indeed, not the same species, but representative ones, whether of animals or plants. The animals

Hosted by Google

of the Old World, both beneficial and noxious, have indigenous species to represent them in the economy of Nature in America. The lion of Asia and Africa is represented by the puma; and the jaguar is known as the American tiger. The llama and alpaca, in like manner, take the place of the camel, horse, and ass. Ostriches, coursing with the fleetness of the wind over the Arabian and African deserts, are represented on the South American plains by the rhea, and in Australia by the emeu. The arctic grebes, whose feathered skins are so much prized for warm winter trimmings, are matched by the penguin of the antarctic. The fishes, reptiles, birds, mammals of the East Indies, find representative species in the West Indies. The gavial of the Ganges and the crocodile of the Nile are genera allied with the alligator of the Mississippi and the cayman of South America. Australian rivers have their analogous reptiles.

A similar divergence in unity is observed in the vegetation. The landscape features of Europe and America in the same zone are different in the midst of strong resemblances. There is an impression of immensity in an American forest which a European one cannot convey. There are oaks, beeches, maples, and wood-nuts, but differing both in magnitude and species. So also is it with the exuberant plains of India and the selvas of the Amazons, both rich in palms; the sago and areca against the coquilla and vegetable ivory; and neither region second to the other. Similarly the three peninsulas of America, Africa, and Australia, regarded as a prolongation of Asia, have harsh leafless plants, as the gum-trees (*Eucalyptus*) and the spurges (*Euphorbiaceæ*). Lastly, to contrast antipodal zones, New Zealand and England possess in common not a plant identically the same, yet the trees in the one country find their counterpart species in those of the other.

Hosted by Google

Hosted by Google

PART II.

THE COMMERCIAL PRODUCTS OF THE VEGETABLE KINGDOM.

INTRODUCTION.

A PLANT is only earth and air, transmuted into those *nutrient* principles which form the food of animals. Plants form the basis of organised life. In the great laboratory of Nature they are employed in supplying the atmosphere with oxygen, and in removing its carbonic acid. No true naturalist will speak of any portion of the vegetable world as useless weeds.

But there are some plants which are especially useful to man, as sources of food, clothing, and medicine; and others are very valuable as furnishing building materials, barks, gums, resins, balsams, dyes, oils, and perfumes. These plants are found in different countries and climates, to which, by a wise arrangement of Providence, they have been restricted. It is natural and useful to inquire "From what countries are they brought?" What quantity of them is annually imported? What are the economic uses made of their products? Obviously, the pursuit of such inquiries must open a wide and instructive field of research.

Numerous as are the vegetable products, hitherto discovered, capable of utilisation, they are few when compared with the inexhaustible wealth of Nature. Not a year but adds in this respect something to our knowledge. When public attention shall be fully directed to this subject, an immense harvest will be reaped. Our limits will only

Hosted by Google

admit of the discussion of the most valuable of them. They may be subdivided into two groups :—

I. FOOD PLANTS.
II. INDUSTRIAL AND MEDICINAL PLANTS.

SECTION I.—FOOD PLANTS.

I. FARINACEOUS PLANTS

THE grasses (natural order, *Graminaceæ*) constitute one of the largest and most widely-distributed of the natural families of plants, appearing in temperate climates in numbers so vast that they form the principal mass of the verdure which covers the landscape. The grasses of tropical climates are generally much loftier than those of the temperate zones, less gregarious, and more tufted. We give the first consideration to the Cerealia, or corn plants, the caryopsis or grain of which contains an abundant farinaceous albumen, capable of great improvement in quantity and quality. The Cerealia have been cultivated from the remotest antiquity, and were thought by the ancients to be the gift of the goddess Ceres. Their native country is unknown, and they have been so changed by cultivation, that we are ignorant, except in one or two plants, of the wild stock from which they are lineally descended. The Cerealia of temperate climates include the European cultivated grasses, wheat, oats, barley, and rye ; maize and rice are the chief cereals of the tropics.

A.—The Cerealia of Temperate Climates.

WHEAT (*Triticum vulgare*, L.).—Wheat is the chief grain of temperate and sub-temperate climates. Its geographical range extends from 30° to 60° N. lat., and 30° to 40° S. lat., in the eastern continent, and Australia. Along the Atlantic portions of the western continent the wheat region

Hosted by Google

embraces the tract lying between 30° and 50° N. lat. In the tropics, wheat is cultivated only in mountainous districts, where the land is sufficiently elevated to be of the proper temperature. It is estimated that in Great Britain 5,000,000 acres are annually covered with this grain.

Wheat is imported into the United Kingdom from almost all parts of the globe. We get soft, red, and white wheat from Austria; the Spanish wheat from Bilbao; Saxanka wheat from St. Petersburg; Australian wheat from Victoria; we also import largely from the United States, the East Indies, and the Brazils. The finest kind of European wheat is from Dantzic, the grain being large, white, and very thin-skinned. 35,645,569 cwts. of wheat were imported in 1867. The largest amounts were received from the southern parts of Russia, from Prussia, and from France.

Wheat was formerly sown broadcast, that is, thrown from the hand of the sower over soil previously prepared by the plough. This is the most ancient mode. In modern times the plan of drilling or dibbling has been adopted; that is, depositing the seed in holes, formed in straight furrows at regular intervals.

When wheat is crushed between the stones of the mill, it is separated into two parts, the bran and the flour. The bran is the outside harder part or tunic of the grain, which, intermingled with the flour, darkens its colour, and is generally sifted or bolted out to a greater or less extent. Bran is used for fattening the stock on the farm, and is of some commercial value in tanning, calico printing, for filling dolls, cushions, &c. The finest kind of bran is called middlings. Pollard is a coarse product of wheat from the mill, but finer than bran.

The whole meal, or the mixture of flour and bran obtained by simply grinding the grain, is as nutritious as the grain itself; and as bran is an alimentary substance, and equal to one-fourth the weight of the whole grain, by its separation much waste of wholesome food is caused. The

Hosted by Google

great importance attached to bread perfectly white is a prejudice. Brown bread, made from the whole meal, should be adopted, not merely on a principle of economy, but as containing the most nutriment.

Flour is largly imported from California and other parts of the United States. We received in 1866 4,972,280 cwts., but in 1867 not more than 3,600,000 cwts.

Oats (*Avena sativa*, L.).—The oat is the hardiest of all the cereal grains, and one of the most elegant of grasses. It can be cultivated in countries where wheat and barley will not grow. Its adaptability to climate is so great that it is cultivated in Bengal as low as 25° N. lat., but it refuses to yield profitable crops as we approach the equator. The oat is cultivated in England, principally in the north and north-eastern counties, and in most parts of Wales and Scotland. It grows luxuriantly in Australia, in Northern and Central Asia, in South America, and over the whole of the cultivated districts of North America.

The meal of this grain is remarkable for its richness in gluten, and for containing more fatty matter than any other of the cereals. To these two circumstances it owes its nutritious and wholesome character. It is, therefore, very suitable, and much in use, as an article of diet for invalids. The variety called the potato oat is a great favourite in Scotland, and is almost the only kind now cultivated there. Oatmeal forms a very considerable portion of the daily food of the Scotch, and oat-cakes are much eaten in the northern counties of England.

We export no oats, as our domestic consumption is equal to the amount grown. The crop of this grain annually raised in the United Kingdom is only half that of wheat.

The use of the oat is very ancient. It is not mentioned in the Bible, but it is alluded to by the Greek and Roman writers Dioscorides and Pliny. Caligula the tyrant is said to have fed his horses with gilded oats; but this

Hosted by Google

report was probably an allusion to the colour of the grain. 9,407,136 cwts. of oats were imported into the United Kingdom in 1867. The greatest quantities came from Russia, Sweden, and British North America.

BARLEY (*Hordeum distichon*, L.).—This grain is one of the staple crops of northern Europe and Asia, growing as far north of the equator as 70°, and as far south of it as 42°, in favourable seasons and situations. In the New World its growth is chiefly confined to Mexico, the middle, western, and northern States, and Canada. In Asia, it is cultivated in the Himalayas and Thibet, replacing wheat in many districts, and producing admirable flour.

Barley is chiefly used for malting and distilling purposes, in making beer and spirits. When the outer coat of this grain is removed, it is called Pearl Barley, and in this form it is valuable for thickening broths and soups. Barley water is a mucilaginous drink for invalids, made by boiling pearl barley.

About 10,000,000 quarters of barley are grown annually in the United Kingdom. Our imports of this grain in 1866 amounted to 8,433,863 cwts., but in 1867 to only 5,683,721. The greatest quantities were received from Denmark, Prussia, France, and Turkey Proper.

Barley is a very ancient article of human food. It is mentioned in the Bible in the Book of Exodus. It has been cultivated in Egypt and Syria for more than 3,000 years. Pliny calls barley the most ancient food of man. It requires very little dressing when sent to the mill, having no husk, and, consequently, no bran. It may be eaten without any other preparation than boiling.

RYE (*Secale cereale*, L.).—This is a highly nutritious grain, but not much raised in this country, except as green fodder for cattle. In Bohemia and most parts of Germany, however, rye forms the principal crop. It is also much cultivated in the north of Europe, and in Flanders, where, mixed with wheat, and sometimes with barley, it forms a leading article

Hosted by Google

of subsistence. The peasantry of Sweden live very generally on rye cakes, baking them only twice a year; they are, therefore, the greater part of the time as hard as a board. Geographically the diffusion of rye and barley is pretty much the same, as these plants generally associate together, growing in similar soils and situations.

Rye-straw is useless as fodder for cattle, but forms excellent thatching material, and a superior article for stuffing horse-collars, so that saddlers will usually pay a good price for it. The amount of rye imported in 1866 was 368,392 cwts.

Rye is much infested by a very poisonous fungus. When attacked in this manner, it is called in England, "horned rye," and in France *ergot*, from a fancied resemblance to a cock's spur. The poisonous influence of this fungus extends not only to human beings, but insects settling on it are killed, and swine, poultry, and other animals, die miserably in strong convulsions, and with mortifying ulcers. Ergot of rye is, however, in the hands of the skilful physician, useful as a remedial agent.

The principal granaries of Europe are Hungary, Russia, Moldavia, and Wallachia; and the chief ports for the exportation of grain, Archangel, St. Petersburgh, Riga, Konigsberg, Dantzig, Stettin, Rostock, Kiel, and Hamburg, in the north, and Taganrog, Kertch, Odessa, and Trieste, in the south. Large flour mills have been recently erected at Mayence on the Rhine, which is now a very important place for this branch of commerce.

B.—The Cerealia of Warm Climates.

Rice (*Oryza sativa*, L.).—This useful grass is a native of the East Indies, whence it has spread to all the warm parts of Asia, Africa, and America. It is a marsh plant, and grows very much like the oat, the grain hanging gracefully from the very thin, hair-like pedicles, forming a loose panicle. Rice is cultivated throughout the torrid zone, wherever there

Hosted by Google

is a plentiful supply of water. Under favourable circumstances it matures on the eastern continent as high as 45° N. latitude, and as low as 38° S. latitude. Its cultivation is principally confined to India, China, Japan, Ceylon, Italy, Madagascar, South Carolina, and Central America.

The rice from the Southern States of America is decidedly the best, being much sweeter, larger, and better coloured than that from Asia, where its cultivation is not so well managed. It is necessary to except Bengal rice, which now nearly equals that growing in the Carolinas. South Carolina produces the best American rice, and Patna the best East Indian variety. Excellent rice is also grown in the Spanish provinces of Andalusia, Valencia, and Catalonia, as well as in the marshes of Upper Italy, especially Lombardy and Venice, and in the plains of Milan, Mantua, Verona, Parma, and Modena, along the river Po.

We imported in 1867 2,773,656 cwts. of rice. Most of our rice comes from the British and Dutch East Indies *viâ* Calcutta and Batavia, and from the Carolinas, Brazil, and Egypt.

The Carolinas and Louisiana now produce annually about 800,000 cwts. of rice, of which 300,000 cwts. are exported *viâ* Charleston and New Orleans; the Brazilian rice comes into commerce from Rio Janeiro, and the Egyptian (500,000 cwts.) from the delta of the Nile, *viâ* Damietta and Rosetta.

Immense quantities of rice are consumed in England, in the form of puddings and confectionery. The straw is plaited for bonnets. Rice-paper is not manufactured from this grain, but is the pith of a shrub called by the Chinese "Taccada," and by botanists, *Aralia papyrifera*, L. The pith, carefully removed from the stem of this plant, is first cut spirally with a sharp knife, then unrolled, spread out, and pressed flat. This paper is much used by the Chinese for water-colour paintings of insects and flowers.

Rice, although regarded by us more as a cheap luxury than a necessary article of food, forms the chief subsistence of the Hindoos, Chinese, Japanese, and other eastern nations.

Hosted by Google

The Burmese and Siamese are the greatest consumers of this grain. A Malay labourer requires 56 lbs. monthly; but a Burmese or Siamese 64 lbs. The South Carolina people do not consume much rice themselves; they raise it principally to supply the foreign demand—the swamps of that state, both those which are occasioned by the periodical visit of the tides, and those which are caused by the inland flooding of the rivers—being well suited to its production. The mountain rices of India are grown without irrigation, at elevations of 3,000 to 6,000 feet above the level of the sea; the dampness of the summer months compensating for the want of artificial moisture.

Rice which comes to us in the husk is called by its Indian name "Paddy." Before it can be used for food this husk must be removed; this is done in India amongst the poorer people by rubbing the grain between flat stones, and winnowing or blowing the husks away. Paddy is now imported into the United Kingdom in preference to shelled rice; there is less loss by waste, and the importers avoid several charges on rice already prepared for use. Our machinery is also better adapted for removing the husk than the ruder methods employed in the countries where rice is produced.

The cultivation of rice undoubtedly dates from the oldest periods of which we have any historical record. Ecclesiastes xi. 1., "Cast thy bread upon the waters, for thou shalt find it after many days," evidently applies to rice, which in Egypt is always sown whilst the waters of the Nile still cover the land, the retreating floods leaving a rich deposit of thick alluvial silt, in which the rice vegetates luxuriantly. A spirituous liquor (*arrack*) is distilled from rice.

MAIZE, or INDIAN CORN (*Zea Mays*, L.).—This plant has a strong reedy-jointed stem, as thick as a broom handle, with large alternate leaves springing from each joint. In favourable situations this stem attains a height of from seven to ten feet; it terminates in a

Hosted by Google

large compound panicle of male flowers called the *tassel*. The female flowers are situated below the male, and spring from the sides of the stem. They consist of ten or more rows of grains or caryopses, situated on the surface of a thick cylindrical pithy axis or stem called the *cob*, from eight to ten inches in length. From each of these grains proceeds a long hairy filament; the whole cob being enveloped by several layers of thin leaves, forming the husk or wrapper. The filaments of the individual grains hang together in a thick cluster out of the husk, and are called the *silk*. The filaments receive the pollen or fertilising matter from the anthers of the *tassel;* a fact easily proved by cutting off the tassel, when the ears prove abortive. After fertilisation, both tassel and silk dry up. This plant when grown up to some height usually sends out several suckers from the lower joints of its stem, which help to maintain its upright position, acting as props or buttresses.

Maize may be raised on the American continent as far to the north and south of the equator as the fortieth parallels of latitude, whilst in Europe its geographical range on either side of the equator extends even to 50° and 52°.

Naturalists are at no loss to determine the native country of maize, which is undoubtedly America, as the Indians throughout the continent were engaged in its cultivation when the New World was first discovered. It now forms the staple grain crop of the United States and Mexico. Since the discovery of America, maize has been introduced into the Old World, and is now grown abundantly in Hungary, Transylvania, Moldavia, and Wallachia. From these countries large quantities are annually sent down the Danube, *viâ* the Wallachian port and fortress of Galatz, into the Mediterranean as far as Malta and Trieste. Maize is also largely grown in the countries around the Mediterranean, and in Southern Germany. It is raised in India and the East Indies, and has been most successfully cultivated in

Hosted by Google

Australia; in a word, in all those regions of the tropical and temperate zones where the white man has established himself.

Like the other cereals, maize may be reduced to meal, the coat of the grain or bran remaining mixed with the flour. Owing to its deficiency in gluten, it is not much used for making bread. In the United States, however, it is made into cakes, and eaten under the name of "corn bread." In this country it is not regarded with much favour as human food, although it is both sweet and nutritious. We import it largely from America, principally for feeding and fattening cattle. In the preparation called *Hominy*, the grain is first soaked, and then exposed to a dry heat which causes the bran or outer coat of the grain to crack and peel off, when it is easily separated. *Pop-corn* is another American preparation of maize made by slightly baking the unripe grains. The corn cobs form a very cheap and useful fuel. We imported in 1866, 14,322,863 cwts., and in 1867, 8,540,429 cwts. of maize, chiefly from the United States and the Turkish dominions.

GUINEA CORN, DURRA, or TURKISH MILLET (*Sorghum vulgare*, Pers.).—"A roundish grain, in shape not unlike maize, but not of greater bulk than a small grain of wheat; its colour is a yellowish white. It is borne in loose tufts or panicles; the stalks are about eighteen inches to two feet in height, and when dry, are very rigid, in this state they are much used in the manufacture of carpet-brooms and whisks. The grain itself is chiefly used in this country for feeding poultry; it is, however, strongly suspected that wheaten flour is not unfrequently adulterated with it, but this can only occasionally take place, as the importation of *durra* is very irregular. It is much used as food for the black population in the West Indies, whence it has been called *negro* corn; they make of it cakes about an inch thick, which are white, and tolerably palatable. It is also used by the poorer peasants of Italy. We receive it chiefly from Northern Africa; it is, however, cultivated largely in the

Hosted by Google

United States, West and East Indies, and in southern Europe. India is its native country."*

C.—*The Leguminosæ* (*Pulse Family*).

This great natural family of plants contains numerous species with wholesome nutritious seeds, which, under the general term *pulse*, form important articles of commerce. These legumes comprise, in temperate climates, the Common Pea (*Pisum sativum*, L.), the Horse Bean (*Faba vulgaris*, Moench), the Haricot or French Bean (*Phaseolus vulgaris*, Sari), the Lentil (*Ervum lens*, L.); and, in the tropics, the Ground Nut (*Arachis hypogæa*, L.), the Chick Pea (*Cicer arietinum*, L.), and the Carob Bean, or St. John's Bread (*Ceratonia siliqua*, L.).

The legumes of temperate climates are familiar plants, and their mode of culture well known. Peas, beans, and lentils are grown in great quantities in Poland, Prussia, Pomerania, Denmark, East Friesland, and other countries. They create considerable business in the large sea-port towns on the Baltic and German seas, whole cargoes being brought to those places as provisions for ships. In 1866, 1,211,835 cwts. of peas were imported to this country, chiefly from Prussia and British North America; and the same year, 1,324,173 cwts. of beans were received, of which 615,912 cwts. were from Egypt, and the remainder from other countries. The tropical species of pulse are not so well known, and require description.

GROUND NUT (*Arachis hypogæa*, L.).—This plant is cultivated in America, in the Southern States, and forms an important article of food in many parts of Africa. It is a low creeping plant, indigenous to the western coast of Africa, with yellow flowers, having the general appearance of a dwarf garden pea, although more bushy. After the flowers drop off, and the pods begin to form, the stalk or support of the pod elongates, *thrusting the*

* Archer's "Economic Botany," p. 8.

Hosted by Google

pod under ground, where it comes to maturity. The seeds contain a considerable quantity of oil. They are roasted in the pods, and are sold in the United States in large quantities, being a favourite dainty with children. This plant is very prolific, and, in warm climates, requires but little care and attention in its culture. In the green state it is greedily devoured by cattle.

CAROB BEAN, or ST. JOHN'S BREAD (*Ceratonia siliqua*, L.).—The carob tree is peculiarly Oriental, and abundant in Palestine. It has large pods, the seeds of which are enveloped in a sweet nutritious pulp, once supposed to be the locust bean on which St. John the Baptist fed when in the wilderness. This tree is common in the Levant and the south of Europe, where its beans are used as food. Most of the carob beans imported into this country come from Sicily and Naples. During the Peninsular war the horses of the British cavalry were frequently fed on these beans.

CHICK PEA (*Cicer arietinum*, L.).—This plant is a native of Southern Europe and the East. Its seeds are parched, and in Spain are sold in the shops for food. They are also abundant in the bazaars at Calcutta, and, under the same name, are sold as food for horses. Every part of this plant exudes oxalic acid, and it is used by the Ryots of India in their curries instead of vinegar. When roasted, it is said to sustain life longer than other food in similarly small quantities; hence it is much used by travellers through the deserts, where the carriage of bulky food is inconvenient.

II.—THE STARCHES OF COMMERCE, AND THE PLANTS WHICH PRODUCE THEM.

Starch is an abundant product of the vegetable kingdom, and is in large demand for domestic and manufacturing purposes. It exists in all mealy farinaceous seeds, fruits, and roots, differing in its appearance according to the

Hosted by Google

plants from which it is obtained. Starch is the nutritive matter of plants, and is changed by light to *chlorophyl*, and by *diastase* into gum and sugar, which are carried into the circulation for the support of the new growths of plants. Starch is turned blue by iodine, an excellent test for detecting its presence in plants.

THE ARROWROOT PLANT (*Maranta arundinacea*, L.; natural order, *Marantaceæ*) is a native of tropical America and the West Indies. In arrowroot, tapioca, and sago, starch exists in a state of almost absolute purity. The arrowroot plant has large, herbaceous, and very handsomely-striped leaves, and tuberous roots, which abound in fecula or starch. These roots are grated, thrown into a vessel of water, and well stirred, when the fibrous portion comes to the surface, and is rejected, the starch settling at the bottom of the vessel as soon as the fluid is permitted to rest. This, after repeated washings, is dried in the sun, and constitutes the arrowroot of commerce, so much employed as a nutritive diet for invalids and young children.

Zamia integrifolia, Wild. (*Coontie*); natural order, *Cycadeæ*. An arrowroot is now manufactured at Key West, in South Florida, from the stem of this plant, which is short and globular, and abounds in starch. This cycad, which was called by the Indians *coontie*, grows abundantly over an immense area of otherwise barren land. These manufactures bid fair to become as extensive and profitable as those of Bermuda, from whence at present our chief supplies of arrowroot are received.

Tous-les-mois, the starch of the rhizome of a species of canna (*C. edulis*); natural order, *Marantaceæ*.—This starch resembles a fine quality of arrowroot; but the granules are much larger than those, or of any known starch. Tous-les-mois comes from the island of St. Kitts, and is only used as food.

TAPIOCA PLANT (*Manihot utilissima*, Plum.; natural order, *Euphorbiaceæ*).—Tapioca is another form of starch,

Hosted by Google

obtained by grating and washing the roots of this plant, which, under the name of mandioc or cassava, forms a most important article of food in South America. This washing removes a narcotic poisonous principle which exists in the sap. The Indians dissipate it by heat, simply roasting the root. The starch thus washed, softened by heat, and afterwards granulated, constitutes tapioca. The ungranulated starch is the Brazilian arrowroot of commerce. The tapioca plant, in its native clime, is a shrub about five feet high, with roots which, when ripe, are about as large as a Swedish turnip, containing large quantities of this nutritive starch, and weighing sometimes as much as thirty pounds.

The common starch of the shops, used in domestic economy, is obtained from wheat, rice, and potatoes, and is almost, if not entirely, home-manufactured.

SAGO PALMS (*Saguerus Rumphii*, Willd.; and *Sagus lævis*, Gœrtn.).—Sago is obtained from several species of palm. The sago of commerce is, however, chiefly produced by these two plants. It is obtained from the cellular tissue, or pith, in the interior of the trunk.

The sago palm produces, like rice, a chief means of nourishment for millions in warm climates, since sago powder is generally used for making bread. It grows in the south of China, Japan, and all over the East Indies, but principally in the islands of the Indian archipelago. This palm generally grows in swampy ground, where it flourishes best, a good plantation being often in a marsh selected for that purpose. Its trunk is from five to six feet in circumference, rising to a height of about twenty feet. The pith, from which the sago is obtained, is of no use until the tree is fourteen or fifteen years old. A single tree is said to yield from five to six hundred pounds of sago.

Most of the sago imported into the United Kingdom comes to us in its granulated form from the island of

Hosted by Google

Singapore, where it is manufactured as follows:—The pith, which is soft, white, spongy, and mealy, is first removed from the interior of the stem, then bruised, and put into large tubs of cold water; the woody particles of course float, and are easily removed, and the weightier starch or sago powder settles at the bottom of the vessel. The water is then poured off, and the dried sago powder passed through small sieves made of the fibres of the palm leaves. In passing through these sieves, the sago powder acquires its granulated character. The preparation is then finished, and the sago is ready to be put into boxes, or placed in bags, for shipment.

The exports from Singapore in the year 1847 exceeded 6,500,000 lbs., but are now much larger.

Sago is insoluble in cold water, but by boiling becomes soft, and at last forms a gelatinous solution. In England it is much used for puddings; and as it is both nutritive and easy of digestion, it constitutes an excellent article of diet for the invalid and the convalescent.

A great deal of German or potato sago, from the manufactories of Vienna, Nuremberg, Schweinfurt, Erfurt, Halle, &c., comes into the European market, and is with difficulty distinguishable from the real East Indian sago.

III.—Plants yielding Spices and Condiments.

Cinnamon (*Cinnamomum Zeylanicum*, Nees.; natural order, *Lauraceæ*).—This plant is an evergreen aromatic tree, about thirty feet in height, and indigenous to the island of Ceylon. Its leaves are oval, smooth, entire, with three prominent curvilinear ribs on the under surface. The young leaves are at first red, but change gradually to a yellowish green, possessing the same flavour as the bark, but in a less degree; flowers panicled, white with a brownish centre, devoid of fragrance, and about the same size as those of the lilac.

The inner bark of this tree constitutes the cinnamon of

Hosted by Google

commerce, and the young twigs furnish the best. After the trees are nine years of age, the twigs are cut annually in the month of May, by the cinnamon peelers, or Choliahs, as they are called in Ceylon. This is done with a sharp iron instrument. The bark is removed by making a longitudinal and then a transverse incision into the shoot, inserting under the bark the point of the peeling-knife, and raising the handle of the knife as a lever. The next day the inner fibrous bark, in which resides the delightful flavour of cinnamon, is easily removed from the outer bark, and this, as it dries, curls up and forms quills. Before these quills become quite dry, hard, and brittle, the smaller are inserted into the larger; space in packing is thus saved, and compact sticks are formed, which are not so liable to breakage as the single quills. The wood from which the bark has been removed is sold for fuel.

"After hearing so much about the spicy gales from Ceylon," says Bishop Heber, "I was much disappointed at not being able to discover any scent, at least from the plants, in passing through the cinnamon gardens. There is a very fragrant-smelling flower growing under them, which, at first, led us into a belief that we smelt the cinnamon, but we were soon undeceived. On pulling off a leaf or a twig one perceives the spicy odour very strongly; but I was surprised to hear that the flower has little or none."

Since neither the leaves nor the flowers of the cinnamon tree give forth any smell, it is only when the season arrives for gathering bark that the visitor to the gardens will enjoy the perfume of this plant. A walk through the cinnamon gardens during the busy season is truly charming. The grove is then full of fragrance, and a scene of cheerful industry. Everywhere are to be seen groups of Cingalese peeling the twigs, which they do with astonishing quickness, making a great deal of money whilst the season lasts. The Choliahs form a distinct caste, and are considered very low, socially, so that, according to Cingalese notions, it is per-

Hosted by Google

sonally degrading for any one else to follow the business. The largest of the cinnamon gardens in Ceylon is that near Colombo, which covers upwards of 17,000 acres of land.

Cinnamon trees are preserved with the greatest care by their proprietors. By the old Dutch law the penalty for cutting or injuring them was amputation of the hand; at present a fine is imposed upon the delinquent.

In 1866, 932,729 lbs., and in 1867, 859,034 lbs. of cinnamon were imported into this country, a great part of which we re-exported to our colonies. Considering the extreme lightness of cinnamon bark, this is a large quantity. Cinnamon is usually brought home in bags or bales of eighty to ninety pounds weight. The best comes from Ceylon, but the cinnamon tree grows plentifully in Java, Sumatra, Malabar, and Cochin-China, and it has been recently transplanted to the Mauritius, the Brazils, and Guiana, and to the West India islands of Tobago, Guadaloupe, Martinique, and Jamaica. The cinnamon produced in the West is, however, not so good as the Oriental.

Cinnamon is an aromatic tonic of an agreeable odour and taste, which acts as a grateful stimulant or carminative, creating warmth of stomach, removing nausea, expelling flatulency, and relieving colic or intestinal pain. It owes these properties to the volatile oil which it contains. Cinnamon is much employed as a condiment in culinary preparations, and is also frequently used for flavouring and disguising unpleasant medicines, or as an adjuvant—that is to say, an assistant.

Cinnamomum Cassia seems to be the chief source of the *Cassia lignea*, or bastard cinnamon of commerce. This plant differs from the true cinnamon tree in many particulars. Its leaves are oblong-lanceolate, and have the taste of cinnamon, to which also its bark bears a great resemblance, but is thicker, rougher, denser, and not so agreeable in flavour. It is cultivated in China, and is imported from Canton, *viâ* Singapore, in chests similar to

Hosted by Google

those in which the tea is packed. 349,349 lbs. of Cassia lignea were imported in 1866.

NUTMEG TREE (*Myristica moschata*, Thunberg).—This tree, from twenty to twenty-five feet in height, strongly resembles our pear-tree in its general appearance, and also in its fruit, which is not unlike the round Burgundy pear. The leaves are alternate, smooth, entire, oblong-pointed, short-petioled, and aromatic when bruised; the flowers, axillary, racemose, pale, bell-shaped, without a calyx. The fruit is a fleshy pericarp, opening by two valves when ripe, and displaying the beautiful scarlet, reticulated arillus, or mace, enveloping the thin, dark-brown, glossy, oval shell, which covers the kernel, the nutmeg of the shops. Each fruit contains a single seed, or nutmeg. The mace and the nutmeg are both valuable spices. The former, although a brilliant scarlet colour when fresh, becomes yellow, brown, and brittle when dry.

Whilst the clove has spread over Asia, Africa, and the West Indies, the nutmeg tree refuses to flourish, except in the islands of the Malayan Archipelago, where it appears to be indigenous. In 1819, 100,000 of these trees were transplanted by the British Government to Ceylon and Bengal, but the plantations were not successful. All attempts to introduce the nutmeg tree into other tropical countries have failed.

The Dutch endeavoured to extirpate the nutmeg from all the islands of the Moluccas except Banda, and they had all the trees removed thither for better inspection; but this attempted monopoly was completely frustrated by the mace-feeding wood pigeons. These birds conveyed and dropped the fruit beyond the assigned limits, spreading it over the whole of the islands of the Malayan Archipelago, from the Moluccas to New Guinea.

About 251 tons of nutmegs, and 68 tons of mace, were imported into the United Kingdom in 1866, nearly half of which were re-exported.

The nutmeg and clove trees were first introduced into

Hosted by Google

this country by Sir Joseph Banks as ornamental hot-house plants, about 1797.

Nutmegs and mace are employed chiefly as condiments for culinary purposes, for which they are admirably suited by their agreeable taste and stimulating properties. As remedial agents they owe their activity to the volatile oil which they contain, and when administered in moderate quantities, produce the usual effect of the other spices.

THE CLOVE TREE (*Caryophyllus aromaticus*, L.; natural order, *Myrtaceæ*, the Myrtle family).—Cloves are the unexpanded flower-buds of this tree, which is an evergreen, the trunk rising from fifteen to twenty feet above the ground. The leaves are opposite, rigid, ovate-lanceolate, smooth, entire, petioled. The flowers are produced in great profusion, in short terminal panicles of from nine to eighteen in each bunch. The four leaves or sepals of the calyx are united; the base of the calyx is tapering and somewhat quadrangular. The corolla is red, and, before expansion, forms a ball or sphere at the top of the calyx. The pedicles, or flower-stalks, are divided into threes, and articulated or jointed. This greatly facilitates the fall of the buds when the gatherers beat the trees with reeds or wands. They are also gathered by hand—a method adopted when the season has been unfavourable.

The clove tree is a native of the Moluccas, where it was very abundant before the conquest of these islands by the Dutch. They extirpated it from all the Moluccas except Amboyna, and even there they allowed only a limited number of trees to be planted, lest the *price should fall too low!* This narrow policy stimulated other nations to try to get so valuable a spice. In 1770 the French obtained the plant, and introduced it into the Isle of Bourbon, and from thence to Cayenne and to their other possessions in America. But the best cloves still come from the Moluccas, those from other places being smaller and containing less oil.

We receive cloves from the East and West Indies, from

Hosted by Google

the Mauritius, and indirectly from Holland. The quantity imported in 1866 was about 541 tons.

Dr. Ruschenberger, who visited Zanzibar, on the eastern coast of Africa, in 1835, thus speaks of the clove plantations there:—"As far as the eye could reach over a beautifully undulating land, nothing was to be seen but clove trees of different ages, varying in height from five to twenty feet. The form of the tree is conical; the branches grow at nearly right angles with the trunk, and they begin to shoot a few inches above the ground. The plantation contains nearly 4,000 trees, and each tree yields, on an average, six pounds of cloves annually. They are carefully picked by hand, and then dried in the shade. We saw numbers of slaves standing on ladders gathering the spice, while others were at work clearing the ground of dead leaves. The whole is in the finest order, presenting a picture of industry and of admirable neatness and beauty."

Cloves, when good, are dark, heavy, and strongly fragrant, the ball on the top being unbroken, and yielding oil when pressed with the nail. This oil is sometimes extracted, and the cloves so treated are mixed with the others. They are also sometimes adulterated with water, which they absorb readily, becoming plumper and heavier.

Cloves are much employed in cookery as a condiment, being the most stimulating of the spices. The oil of cloves is a popular remedy for the toothache, and the infusion a warm and grateful stomachic. Cloves are frequently employed by medical men to disguise the nauseous properties of their drugs, and thus render them more palatable to the patient.

ALLSPICE, PIMENTO, or JAMAICA PEPPER (*Eugenia Pimento*, D.C.; natural order, *Myrtaceæ*).—This plant is called *allspice* because it has the combined flavour of all the other spices—that of cinnamon, cloves, and nutmegs entering into its composition. The unripe berries of this plant, dried in the sun, form the allspice. The plant itself is a handsome ever-

Hosted by Google

green, with a straight trunk about thirty feet high, covered with a smooth grey bark. Its leaves are opposite, short-petioled, elliptical, smooth, and pellucid-dotted, abounding in an essential oil, to which the pimento owes its aromatic properties. The flowers are greenish white, and the fruit is a smooth, shining, succulent berry, black when ripe, and containing two uniform seeds, the flavour of which resides within the shell.

The allspice is a native of the West Indies where it is cultivated—particularly in Jamaica, in the hilly parts of the country—in plantations, having broad walks between the trees, called "pimento walks." It begins to bear fruit when three years of age, and arrives at maturity in seven years. Nothing can be more fragrant than the odour of the pimento trees, especially when in bloom; even the leaf emits a fine aromatic odour when bruised.

The berries are collected before they are ripe, at which time the essential oil, to which they owe their flavour and pungency, is most abundant. They are spread out, exposed to the sun, and often turned. In about a week they have lost their green colour, and have acquired that reddish-brown tint which renders them marketable; they are then packed in bags and casks for exportation. When dried, these berries are rather larger than a peppercorn. Some plantations kiln-dry them, which expedites the process very considerably.

The consumption of allspice in this country is very great, as it is both cheap and useful; 22,000 bags, weighing 1,022 tons, were imported into Liverpool and London in 1850, and about one-fifth of that quantity was re-exported. This spice is used as a condiment, and its oil, like that of cloves, is employed as a remedy for toothache.

PEPPER (*Piper nigrum*, L.; natural order, *Piperaceæ*).—This is a climbing vine, with alternate, ovate, acuminate, dark green leaves, five to seven-nerved beneath, and small inconspicuous flowers, in long, slender, drooping spikes,

Hosted by Google

which are opposite. Its fruit is a round, sessile, one-sided berry, first green, then red, and finally black.

The pepper vine is indigenous in the East Indies, and is extensively cultivated in Sumatra, Java, and on the Malabar coast. A little pepper is also grown in the Mauritius and in the West India islands.

The berries, which resemble those of our holly in size and colour, are gathered as soon as they begin to redden; for if allowed to ripen fully, they lose their pungency. They are dried in the sun. In drying they become wrinkled and black, in consequence of the drying of the pulp over the greyish white seed. In this state they are known as black pepper, which is the most powerful variety.

White and black pepper are produced by the same plant. This difference in colour is only the result of a difference in the preparation of the berries. To obtain white pepper the berries are allowed to ripen, then dried and soaked in water, and the softened black outer coat is removed by rubbing. The internal seed is of a whitish grey colour, and, when dried, forms white pepper.

Pepper is a warm carminative stimulant, which is added to food principally for the object of correcting the flatulent and griping character of certain articles of diet—peas and beans, for instance. Both varieties of black and white pepper are sometimes used whole, in soups and pickles, but they are mostly ground in a mill, and sold in the form of a powder.

The quantity of pepper annually imported into the United Kingdom is immense. About 6,523 tons of the dried unripe black berries and white ripened seeds of the pepper plant reached this country from the East Indies in 1866, chiefly from Sumatra and Java, and also from Malacca, Siam, and Singapore.

The pepper vine is strictly tropical, but it will grow freely from cuttings wherever the soil and climate are suitable. It is allowed to climb props from ten to thirteen

Hosted by Google

feet in height; these props root freely, the tree from which they are cut being selected with that object in view. The props thus afford both shade and support to the plants. Great care is necessary in the management of the vine, especially in training and tying it to the props. An acre of pepper vines affords an average annual yield of 1,161 lbs. of clean pepper.

LONG PEPPER (*Piper longum*, L.; natural order, *Piperaceæ*). This species is wholly different from the black pepper, and is found wild in India, and cultivated in Bengal. The long pepper consists of the fruit catkins of the plant dried in the sun. Long pepper is expensive, and therefore not much used either as a condiment or a medicine.

CAYENNE PEPPER (*Capsicum annuum*, L.; natural order, *Solanaceæ*).—Cayenne or red pepper is not the produce of a pepper plant, but of one belonging to a totally different natural order. It is prepared from the large, red, inflated, pod-like berries of the capsicum, dried and reduced to powder.

The capsicum is a native of the East and West Indies, but cultivated in England, where it can be grown with a very little care. There are numerous species of capsicum, named after the form and colour of the pod, which varies considerably. All are, however, included under the Mexican name of Chillies.

In tropical countries chillies are used in great quantities, the consumption as a condiment being almost universal, and nearly equal to that of salt. In India they are the principal ingredients in all curries, and form the only seasoning which the millions of the poor of that country can obtain to eat with their insipid rice. The natives of the tropics can eat and relish them raw, which cannot be done by strangers from temperate climates without suffering, the pungent and acrid action of the chillies affecting the mouth and throat.

Capsicums or chillies are imported into this country in the form of red and brown pods, which are broken, dried,

Hosted by Google

and packed in bales, weighing 2½ cwts., principally for making red pepper. Different varieties are cultivated for pickles, and are imported in the pickled state in vinegar from the East Indies. The annual imports from the East and West Indies are about 80 tons.

Capsicums are useful in cases of putrid sore throat, in malignant scarlet fever, as a powerful irritant to be applied in the condition of a saturated infusion externally, so as to draw the internal inflammation to the surface, and thus relieve the throat.

GINGER (*Zingiber officinale*, Roscoe; natural order, *Zingiberaceæ*).— This is an elegant, reed-like, tropical plant, which rises from a creeping *rhizome* or underground stem. The aërial stem is formed by the cohering bases of the leaves which are alternate, lanceolate, and sheathing, the nervures diverging from the mid-ribs. The flower stem springs from the rhizome. The dark purple flowers are arranged in spikes.

The ginger-plant is a native of the East and West Indies, and is now cultivated generally in hot climates. The ginger of commerce is the dry, wrinkled rhizomes of the plant, which are called "races," and are usually from two to three inches in length, branched, flat, and white in colour. Sometimes the root is dug up when a year old, scalded to prevent germination, and then dried. So prepared, it is called "black ginger," although this term is very erroneous, as the darkest ginger is only a dirty stone colour. Again, the best pieces are selected, the outer skin is scraped off before the ginger is dried, and the pieces, bleached with chloride of lime, constitute what is known in the market as "white ginger." This bleaching process renders the ginger beautifully smooth, but certainly does not improve its quality. Lastly, the *races*, newly formed in spring, are cut off, and boiled in syrup; and the ginger, so treated, is imported in jars under the name of preserved ginger, forming a well-known sweetmeat.

The varieties of ginger recognised in commerce are the

Hosted by Google

Jamaica white ginger, and the Jamaica and Malabar black gingers; also the black varieties, or the Barbadoes, African, and East Indian gingers. Jamaica ginger is considered to be the best. The amount of ginger annually imported into the United Kingdom is 2,000 tons. The principal use of this spice is as a condiment. Medicinally it is an excellent stomachic, removing flatulence and griping pains. In the form of a poultice, it forms a good rubefacient or counter-irritant.

CARDAMOMS (*Elettaria cardamomum*, Maton; natural order, *Zingiberaceæ*).—Cardamom seeds are obtained from several other allied plants, but those of the above species of *Elettaria* constitute the true officinal Malabar cardamoms.

The cardamom is an obtusely triangular three-celled pod, about half an inch in length, of a pale straw colour, and furrowed longitudinally on its outer surface. This pod contains numerous reddish-brown, rugose seeds, about the size of mustard seeds, internally white, and having a pleasant aromatic odour and an agreeable taste.

Cardamoms are principally employed here in medicine as a flavouring ingredient, and occasionally as a stimulant and carminative, especially in the form of a simple or compound tincture. In India they are much used as a favourite condiment for various kinds of food, as curries, ketchups, and soups. Their active principle is a pungent volatile oil.

Cardamoms are shipped to this country from Ceylon, the Malay peninsula, Sumatra, Java, Siam, Cochin-China, and the Malabar coast. The quantity of all kinds imported is about twenty-five tons per annum.

VANILLA (*Vanilla aromatica*, Sw.; natural order, *Orchidaceæ*).—The vanilla is an epiphyte or air-plant with a trailing stem, not unlike the common ivy, which attaches itself to trees not as a source of food, like the mistletoe and other parasites, but as a mere point of support, deriving its nourishment entirely from the atmosphere. It grows from eighteen

Hosted by Google

to twenty feet in length. The flowers are greenish yellow mixed with white, and these are followed by a long slender pod, the fragrance of which is owing to the presence of benzoic acid, crystals of which form upon the pod if left undisturbed. This is, perhaps, the most important genus of the whole orchideous family, and the only one which possesses any marked economic value. It grows in the tropical parts of South America, in the Brazils, Peru, on the banks of the Orinoco, and in all places where heat, moisture, and shade prevail.

The pods or fruit of the vanilla are sub-cylindrical, about eight inches long, one-celled, and pulpy within, filled throughout their entire length with very minute black oily seeds, having the appearance of a black paste.

To prepare vanilla for market—"When about 12,000 of the pods are collected, they are strung like a garland by their lower ends, as near as possible to their foot-stalks; the whole are plunged for an instant into boiling water to blanch them, they are then hung up in the open air, and exposed to the sun for a few hours. Next day they are lightly smeared with oil, by means of a feather or the fingers, and surrounded with oiled cotton to prevent the valves from opening. As they become dry on inverting their upper end, they discharge a viscid liquor from it, and they are pressed several times with oiled fingers to promote its flow. The dry pods lose their appearance, grow brown, wrinkled, and soft, and shrink into one-fourth of their original size. In this state they are touched a second time with oil, but only very sparingly, because if oiled too much, they would lose a great deal of their delicious perfume. They are then packed for the market in small bundles of 50 to 100 in each, enclosed in lead foil or light metallic cases."*

As an aromatic, vanilla is much used by confectioners for flavouring ices and custards. The Spaniards employ it

* See Ure's "Dictionary of Arts and Manufactures," Vol. 3, p. 974. 1867.

Hosted by Google

extensively in perfuming their chocolate. It is difficult to reduce it to small particles, but it may be sufficiently attenuated by cutting it into little bits, and grinding these along with sugar. The quantity imported into this country is very small, amounting to between five and six cwts. per annum.

There are a few seeds which, from their pungent aromatic flavour, are used as condiments, and may very properly be classed with the spices.

Umbelliferous Plants with Aromatic Fruits.

The fruits of the caraway, coriander, and anise—called in commerce seeds—although cultivated in this country, are imported somewhat largely from the Continent, and are therefore deserving of notice.

CARAWAY (*Carum carui*, L.).—The caraway is indigenous to most parts of Europe, as well as to this country. It is cultivated to some extent in Essex and Kent. The taste of the seeds is aromatic and warm, and their odour is fragrant, but peculiar. The seeds are much used by the confectioner, and are sometimes added to bread; coated with sugar, they form the well-known "caraway comfits" to which children are so partial. We import about 500 tons of caraway seeds annually from Germany and Holland, nearly the whole of which are retained for home consumption.

CORIANDER (*Coriandrum sativum*, L.).—The fruit of this plant is globose, having a peculiar smell, and a pleasant, aromatic taste. In a fresh state both the fruit and foliage have an extremely disagreeable odour; nevertheless, the Tartars are said to use it in the preparation of a favourite soup.

The coriander is indigenous to Southern Europe and Italy, but has a wide geographical range, bearing the climate of India and Britain equally well. It is cultivated in this country, particularly in Suffolk and Essex, and is valued both by the apothecary and the distiller. Coriander is used in

Hosted by Google

medicine for its carminative and aromatic properties, as a corrective to the griping qualities of cathartics. It is more used in confectionery than in medicine. Coriander seed is also employed in adulterating beer. The poor Indian mixes these seeds with his curry, and they are equally welcome at the tables of the rich. Our imports from Germany average fifty tons per annum.

ANISE (*Pimpinella anisum*, L.).—This is a perennial plant, with an erect, round, striated, rough, or downy stem; pinnatisect leaves, white flowers, and an ovate, downy, aromatic fruit, resembling the finer kinds of parsley seed in shape, and grateful and sweetish to the taste.

The oil of anise is obtained by distillation from the seed, about one cwt. of seed yielding two lbs. of the oil. It is used in confectionery and in medicine. Anise is indigenous to Egypt, but is now largely grown in Malta, Spain, Italy, France, Germany, and the East Indies. The principal imports are from Alicant in Spain, and Hamburg in Germany, and average about seventy tons per annum.

Other umbelliferous plants used as condiments are cumin and angelica.

STAR ANISE (*Illicium anisatum;* natural order, *Magnoliaceæ*).—This plant is so called because the flavour of aniseed pervades the whole of it, especially the fruit; but it is not at all allied to anise, belonging to a totally different natural order. It is a shrub indigenous to China and Japan; its fruit is used to flavour sweetmeats, confectionery, and liquors. The aromatic oil of star anise, singularly enough, in every respect resembles anise oil, for which it is often substituted. In India, star anise is an important article of commerce, and sold in all the bazaars.

MUSTARD.—The seeds of *Sinapis nigra*, L., often mixed with *S. alba* (natural order, *Cruciferæ*).—The spherical seeds of these two species are crushed, pounded, and then sifted through a fine sieve; the fine, powdery product is the

Hosted by Google

"flour of mustard" in common use. The outer skin of the seeds, separated by sifting, forms a coarse powder, which is sold for adulterating pepper. Mustard seed is largely imported from the East Indies for the expression of oil; and white mustard seed is imported from Northern Germany, in small quantities, for grinding with the black mustard seed grown in this country.

IV. Plants yielding Sugar.

Sugar-cane (*Saccharum officinarum*, L.; natural order, *Gramineæ*).—This plant, next to rice and maize, is the most valuable of the tropical grasses. Its stem, which is solid, cylindrical, and jointed, is two inches in diameter, and from twelve to fifteen feet in height; its leaves are long, narrow, and drooping; flowers very handsome, appearing like a plume of white feathers, tinged with lilac. A field of sugar canes in blossom presents a very beautiful appearance.

The sugar-cane is seldom permitted to flower under cultivation. It is propagated by sections of the culm, or stem, with buds in them. Trenches are cut, and the pieces of the culm are laid horizontally in them; the earth is then thrown into the trench, and the canes soon develope from the nodes or joints of the culm. As they grow up, and the wind gains power over them, the lower leaves are removed, and the stems are strengthened by being fastened to bamboo supports.

The sugar-cane plant is very sensitive to cold, and therefore its cultivation is restricted to the tropics, and to regions on their borders where there is little or no frost. In the Old World sugar plantations are confined to countries lying between the 40th parallel of north latitude, and a corresponding degree south; in America, along the Atlantic seaboard, they do not thrive beyond 33° north latitude, and 35° south latitude; whilst on the Pacific side, the sugar-cane matures about 5° further to the north and south of the equator. The principal countries where sugar is

Hosted by Google

largely grown are the West Indies, Venezuela, Brazil, Mauritius, British India, China, Japan, the Sunda, Philippine, and Sandwich Islands, and the Southern United States of America. Moreton Bay and the northern parts of Australia are admirably suited, both in soil and climate, to sugar culture.

Manufacture of Sugar.—When the cane is ripe, it is cut down, deprived of its top and leaves, cut up into convenient lengths, tied up in bundles, and taken to the mill. Here the canes are crushed between iron rollers, the juice from them flowing into vessels, where it is boiled with the addition of lime, and evaporated to the consistence of syrup, care being taken to remove any scum which appears on the surface during this part of the process. The lime is added to remove any acidity and prevent fermentation. The material of the fire consists of the refuse crushed cane, dried for that purpose in the sun. Six or eight pounds of cane-juice will yield one pound of raw sugar; and from sixteen to twenty cart-loads of cane ought to make a hogshead of sugar, when thoroughly ripe. The cane syrup thus prepared is transferred to shallow vessels, or coolers, in which it is stirred until it becomes granulated; it is then put into hogsheads having holes in the bottom, which are placed in an upright position over a large cistern, and allowed to drain. In this state it is called muscovado or brown sugar, and the drainings, molasses. The casks are then headed down and shipped. This muscovado is purchased by the grocers, and constitutes the brown or moist sugar of the shops.

The planters in the West Indies generally send their sugar to England in the form of muscovado; but in the French, Spanish, and Portuguese settlements, it is usually converted into clayed sugar before exportation. The process is as follows:—The sugar from the coolers is placed in conical pots with holes at the bottom, having their points downward. A quantity of clay is laid on the top and kept

Hosted by Google

moistened with water, which oozing gently from the clay through the sugar, dilutes the molasses, and causes more of it to come away than in the hogshead, leaving it whiter and purer than the muscovado sugar.

Loaf, or refined sugar, is made from the muscovado by the sugar bakers in England. The muscovado is re-boiled, and refined with the serum of bullock's blood or the white of eggs; it is then transferred to conical moulds, and clayed repeatedly until perfectly white. The sugar is then removed from the moulds and set in a stove to dry.

The sugar-cane, a plant originally confined to Asia, and which grew wild in India, was introduced into the south of Europe from the East by the Saracens soon after their conquests in the ninth century. In the twelfth century, sugar plantations were established in Cyprus, Rhodes, Candia, Malta, Sicily, and Spain; and as early as the beginning of the fifteenth century they had been extended to Granada, Murcia, Portugal, Madeira, and the Canary Islands.

The sugar-cane is now cultivated at only a few places in Europe, viz., Malta, Sicily, and the south of Spain. The rest of the sugar plantations have disappeared from the countries about the Mediterranean, in consequence of the extent of the great American plantations, and those in the West Indies.

In the middle of the sixteenth century the sugar-cane was transplanted by the Portuguese to Brazil, and by the Spaniards to the West Indies, where the greatest quantity of sugar is now produced. Brazil has now 900 sugar plantations, producing annually about 50,000 tons of sugar; and of the West India Islands, Cuba and Jamaica alone raise 150,000 tons for export hither yearly. Porto-Rico, and the French, Dutch, and Danish colonies in the West Indies export sugar largely, as do also Louisiana and Alabama, by way of New Orleans. The exports of sugar from Mexico go mostly to New Granada, Caracas, and Ecuador in South America.

Hosted by Google

The East Indies, Java, Sumatra, the Philippine Islands, Siam, Cochin-China, Bengal (but not Ceylon) produce sugar for exportation. Sugar has been made in China, indeed, from very remote antiquity, and large quantities also have been exported from India in all ages.

In 1866, 10,639,085 cwts. of raw sugar were imported into the United Kingdom, of which, 5,823,729 cwts. were received from our colonies, and the rest from foreign countries. Of this amount 10,297,196 cwts. were retained for home consumption, and the remainder shipped to foreign countries.

Rum, or Spirit of Sugar.—The best is distilled from the pure juice of sugar, the inferior kind is made from treacle, and from the residuum in the sugar refineries. Jamaica rum is the finest, about three millions of gallons being annually imported into England from the West Indies. Rum is also distilled for exportation in Bengal, Penang, Batavia, and Manilla. The native arrack of India has been nearly driven out of the market by this spirit.

Besides the sugar cane, many other plants yield sugar. The principal of these are :—

1. BEET-ROOT AND MANGOLD-WURTZEL (two varieties of *Beta vulgaris*, Tournef; natural order, *Chenopodiaceæ*) are cultivated very extensively on the continent of Europe, especially in France, where a great portion of the supply of sugar is obtained from the juice of these sap roots. In Great Britain beet-root is eaten as a salad, and mangold-wurtzel is largely grown as winter food for cattle.

2. SUGAR MAPLE (*Acer saccharinum*, Wang.; natural order, *Aceraceæ*).—From the juice which flows from incisions made in the stem of this, and probably other, species of maple, large quantities of a coarse uncrystallisable sugar are manufactured in North America.

3. DATE (*Phœnix dactylifera*, L.; natural order, *Palmaceæ*).—From this useful palm (see p. 183), and also from *P. sylvestris*, L., and *Saguerus Rumphii*, sugar is produced

Hosted by Google

by boiling the juice, which flows from incisions made in the flower-heads; from *P. sylvestris*, L., alone as much as 6,000 tons are made annually. These sugars are mostly consumed in India; much, however, is supposed to be imported to this country as cane sugar.

V.—Plants useful in the Preparation of Nutritious and Stimulating Beverages.

The Tea-Plant (*Thea viridis*, L., and *Thea Bohea*, L.; natural order, *Camelliaceæ*).—These two species are probably only varieties of the same plant. Native region, China and Japan.

The tea-plant is an evergreen shrub which attains in a state of nature a height of from twenty-five to thirty feet, but under cultivation seldom exceeds five or six feet in height, owing to the removal of its foliage by the cultivator. The leaves are alternate, short-petioled, smooth, shining, ovate-oblong, stiff and coriaceous, and slightly dentate on the margin.

All the numerous varieties of tea known in commerce are referable to one or other of the two grand divisions of green and black tea. Both are most undoubtedly produced by the same plant, the difference in their colour resulting simply from a difference in their mode of preparation.

The green teas comprise Twankay, so called after the name of a stream in Chehkiang, where this sort is produced; Hyson, or, in Chinese, *yu-tsien*, meaning "before the rains," in allusion to the time of gathering; Gunpowder, or *ma-chu*, "hemp-pearl," referring to the peculiar globular form into which the leaves are twisted; Imperial—the finest kind of green tea—so named because it is only used by the emperor and the mandarins—this tea consists of the smallest and most tender light-green leaves of the first gathering; it is not easily obtained in Europe in the pure state.

Hosted by Google

The black teas include Bohea, named with reference to the range of the Bu-i hills, where it is grown; Congou, or *koong-foo*, signifying labour or assiduity; Souchong, or *siau-chung*, meaning small or scarce sort; and Pekoe, or *pe-kow*, "white hairs," in allusion to the down on the epidermis of the young spring leaves. The two last are the finest and most expensive of the black teas.

The preparation of green tea may be described in general terms as follows:—The leaves are gathered from the shrub, and placed in bamboo baskets; they are then put into shallow iron pans, placed over charcoal fires, and stirred continually and briskly, the rising steam being fanned away; after this they are removed from the pans, and whilst still flaccid with the contained moisture, are placed before the twisters, on a table made of split bamboo, and therefore presenting ridges; the twisters roll them over with their hands until twisted. The leaves are then spread out and exposed to the action of the air, and afterwards returned to the drying-pans, exposed there to additional heat, and kept continually stirred until the drying is complete, when they are picked, sifted, sorted, and so prepared for packing. Black tea is prepared in the same manner, with this difference, that the fresh leaves, as soon as collected, are thrown together into heaps, and allowed to lie until a slight degree of fermentation ensues, or a spontaneous heating, similar to that which takes place in a damp hay-stack. This partial fermentation of the tea-leaves darkens their colour. All the black teas are grown in Fokien, a hilly and populous district about 200 miles to the north-east of Canton. The green teas are raised in the district of Kianguan, about 750 miles from the same city.

Owing to certain peculiarities in Chinese legislation, landed property is much subdivided, so that the tea is generally cultivated in small gardens or plantations, the leaves being picked by the family of the cultivator. The first gathering takes place in early spring, in the month

Hosted by Google

of April—pekoe and hyson are made from this crop. It is scarcely over before the air becomes charged with moisture, rain falls, and this, combined with the warmth of the atmosphere, causes the tea-shrubs soon to put forth, in the month of May, the leaves of the second crop. A third gathering is made about the middle of June, and a fourth in August. The leaves of the first gathering are the most valuable, and from these the finest imperial and hyson, with pekoe, and similar qualities of black teas, are prepared. The leaves of the last crop are large and old, and consequently make preparations very inferior in flavour and value.

During the harvest season, when the weather is dry, the Chinese may be seen in little family groups on every hillside engaged in gathering the tea-leaves. They strip off the leaves with astonishing rapidity, and throw them into small round baskets made for this purpose out of split bamboo or rattan. These baskets, when filled, are emptied into larger ones, and immediately conveyed to market, where a class of Chinese make it a business to collect them in large quantities, and partly manufacture them, drying them under a shed.

A second class, known as the tea-merchants, purchase the tea in this half-prepared state, and complete the manufacture, employing in the operation women and children. The tea-merchants begin to arrive in Canton about the middle of October, and the busy season continues until the beginning of March, being briskest in November, December, and January. The tea is brought to Canton either by land-carriage or by inland navigation. The roads are too bad to admit of beasts of burden attached to wheeled vehicles, so that the land-carriage is usually effected by porters.

In China tea is the common beverage of the people, being sold in the public-houses in every town, and along the public roads, like beer in England. It is quite common for travellers on foot to lay down their load, refresh them-

Hosted by Google

selves with a cup of warm tea, and then proceed on their journey. A Chinaman never drinks cold water, which he abhors and considers unholy; tea is his favourite drink from morning to night, not mixed with milk or sugar, but the essence of the herb itself, drawn out with pure water. The Chinese Empire could hardly exist were it deprived of the tea-plant, so habituated are the people to its use; and there is no doubt that it adds greatly to their health and comfort as a nation.

The Japanese usually make tea by pouring boiling water on the leaves, after having first reduced them to powder. Neither the Chinese nor the Japanese use milk or sugar with tea; and certainly the peculiar taste and aroma of the tea are better appreciated without these additions.

Tea is imported in chests always lined with thin sheet-lead, and with a paper which the Chinese manufacture from the liber or inner bark of the paper mulberry (*Broussonetia papyrifera*, L.). It is silky in texture, straw-coloured, and made without size. When the tea is put into the boxes, it is pressed down first with the hand, and then with the feet, after which the boxes are nailed down and stamped with the name of the district grower or manufacturer.

The Chinese colour with Prussian blue the teas which they ship for the foreign market. Only a little of this dye is employed, so that its use is not productive of evil results; still, the tea would be better without it. The Chinese never dye the teas which they retain for their own use. The green teas of commerce are too often only black teas coloured with Prussian blue. Nevertheless, comparatively speaking, very little adulteration of tea is practised by the Chinese. A few leaves of the *Camellia* and of a species of *Rhamnus* or buckthorn indigenous to China are found occasionally amongst the tea-leaves, but not to any very great extent. The leaves of such British plants as the beech, elm, willow, poplar, hawthorn, and sloe, are far more abundant, proving that the tea is adulterated after it has

Hosted by Google

arrived in this country. The adulteration is easily detected by comparing the leaves from the teapot with the genuine tea-leaf. Tea is also adulterated with old exhausted tea-leaves, which are re-dried and used again.

In 1866, 139,610,044 lbs. of tea were imported into the United Kingdom, of which quantity 102,265,531 lbs. were retained for home consumption; in the same year we exported 30,245,454 lbs. to foreign parts.

The consumption of tea by the Chinese themselves is enormous. They drink four times as much as we do. With rich and poor of all that swarming population, tea—not such as our working classes here drink, but fresh and strong, and with no second watering—accompanies every meal. The population of China, according to an official census taken in 1825, was 352,866,012, which is more than ten times our population. Estimating our annual consumption of tea at about one million cwts., that of China must be forty times that quantity. In addition to this there is a very heavy exportation in native vessels from China to all parts of the East where Chinese emigrants are settled, such as Tonquin, Cochin-China, Cambodia, Siam, the Philippines, Borneo, the settlements in the Straits of Malacca, California, and Australia. In comparison with such an enormous amount as this our own consumption sinks into insignificance.

The caravan or Russian teas are the best and most expensive used in Europe. They are brought overland from China by Russian merchants, who go there annually in caravans *viâ* Kyachta. These caravan teas, purchased by the wealthier Russian families, are preferred to those shipped in Canton, which are said to deteriorate in some degree through the sea air, and from being stowed away in the narrow and close holds of the vessels.

Tea was first brought to Europe by the Dutch in 1610, and they had for a long time the monopoly of the trade. But the British East India Company entering the field as a

Hosted by Google

competitor, soon obtained a fair share of the business. The sole object of the Company was to provide tea for the English market; of this they had the exclusive monopoly until 1834, when the British Government passed an Act which threw open the tea trade to all disposed to engage in this important branch of commerce.

Formerly all the tea received in Europe was cultivated exclusively by the Chinese, now the culture of the tea-shrub is successfully carried on in other countries.

The Dutch were the first to break the charm of the Chinese monopoly, by introducing and cultivating the tea-plant in the rich and fertile island of Java. Their first experiment was so successful that numerous tea-gardens were soon under cultivation on the mountain range which runs through the centre of the island, where the plant escapes the scorching heat of the torrid zone, and finds a climate by height, rather than by latitude, adapted to its nature. A considerable quantity of tea is now annually shipped from Java to Amsterdam.

In 1810 an attempt was made to cultivate the tea shrub in the Brazils, near Rio de Janeiro, and a colony of Chinese were induced to settle there and attend to the plantations. But the experiment did not succeed; the shrubs became diseased, and the Chinese formally abandoned them. Another effort made in the same country in 1817 was unsuccessful, owing to difficulties arising from climate, the high price of labour, and the natural indolence of the natives. The experiment, however, was tried once more, and this time successfully, and tea culture is now prosecuted with energy in the Brazils, and with a commensurate amount of success. The Rio Janeiro market is entirely supplied with tea of domestic growth; and the public of Brazil are satisfied that no plant is more profitable or deserving of attention.

Tea is now cultivated in British India. Some years ago it was discovered that the tea plant was indigenous to our Indian territory of Upper Assam. This plant, supposed

Hosted by Google

to be a distinct species, has received the name of *Thea Assamica.* It is a more vigorous plant than the Chinese species, and has much larger leaves. It grows in the warm moist valleys of the Himalaya mountains, the temperature and other conditions there being similar to the circumstances under which the Chinese plant is raised. The Assam Tea Company was started, and several thousand acres were soon under cultivation in the district stretching from Kemaon to the *hill tracts* acquired from the Sikhs. The plants grown are chiefly those raised from Chinese seed, the remainder are the indigenous plants of the district. The seeds of the Chinese plant were obtained by Mr. Fortune in China in the summer of 1850, and by him planted in Wardian cases. They germinated during the voyage, and reached their final destination—the plantations of the Himalayas—in fine condition. About 14,000 plants were thus added to the Assam collection. Chinese tea curers have been induced to settle in Assam, and both black and green tea are now manufactured from the Chinese and Assam plants. The latter produces a very strong tea, which answers well to mix with the low sorts of China tea, and is chiefly used for this purpose. Large importations of tea from Assam have already been received in this country. Land suitable for the culture of tea exists amongst the Himalayas to an almost unlimited extent, and the quantity raised annually and exported must increase as the plantations are extended and multiplied.

PARAGUAY TEA, or MATÉ (*Ilex Paraguayensis;* natural order, *Aquifoliaceæ*).—A small shrub with oval, wedge-form, or oblong-lanceolate, toothed, smooth leaves, somewhat like those of the orange. This plant, which is, in fact, a species of holly, occupies the same important position in the domestic economy of South America that the Chinese plant does in this country. The leaves are prepared by drying and roasting—not in the manner of the Chinese teas, in which each leaf is gathered separately; but small

Hosted by Google

branches with the leaves attached to them are cut from the plant, placed on hurdles over a wood fire, roasted, and then beaten on a hard floor with sticks. The dried leaves and stems thus knocked off are collected, reduced to powder, and packed in hide sacks. Each of these sacks, when full, contains from 200 to 250 lbs. of the tea. The sacks are sewed up, and as the hide dries and tightens by exposure to the sun over its contents, at the end of a couple of days the tea forms a substance as hard as stone, and almost as heavy.

As found in commerce, Paraguay tea is, therefore, in the form of a greenish-yellow powder, mixed with broken leaves and stems. This is infused in boiling water, and the decoction is drunk, or rather sucked up, by means of a tube perforated with small holes. It is usually imbibed out of a small gourd or cup with a little sugar, and sometimes an aromatic is added, such as orange or lemon-peel, or cinnamon, to give it an additional flavour. Maté is generally disagreeable to those unaccustomed to its use, but a taste for it is soon acquired, and it is very refreshing and restorative to the human frame after great fatigue.

It has been calculated that 40,000,000 lbs. of Paraguay tea are annually consumed in the various South American Republics. Mr. Miers gives eight sources of *maté*.

COFFEE TREE (*Coffea Arabica*, L.; natural order, *Rubiaceæ;* sub-order, *Cinchonaceæ*).—An evergreen shrub, from fifteen to twenty feet in height, with an erect stem covered with a brownish bark, and opposite branches with a slightly downward inclination, giving to the whole shrub an elegantly beautiful pyramidal contour or outline. Leaves opposite, short-stalked, ovate-lanceolate, entire, glossy dark-green above, paler beneath, and from two to three inches long; flowers, white and funnel-shaped; fruit, a globular two-celled and two-seeded berry, about the size of a cherry. The seeds, freed from their hard, horny parchment-like husk, are hemispherical, with one side convex, and the other flat and furrowed.

Hosted by Google

The flowers of the coffee-tree resemble those of the white jessamine, and appear in clusters in the axils of the leaves. The trees are very beautiful and fragrant when in bloom, and not less attractive when the berries are ripe and ready for cropping, for these are then of a deep scarlet colour, and show to great advantage amongst the dark-green glossy leaves.

The home of the coffee-tree is said to be Abyssinia, where it still grows wild; thence it was transplanted to Arabia towards the close of the fifteenth century. It was introduced by the Dutch into Batavia in 1690, and thence carried to the West Indies in the beginning of the eighteenth century, and afterwards to the Brazils. Coffee is now grown in almost every tropical country having an average temperature of above 55°. We receive it from Java in the East Indies, from Trinidad in the West Indies, and from Rio Janeiro in South America. The best coffee comes from Mocha in Yemen, the southernmost province of Arabia.

As soon as the crimson colour of the coffee berry indicates the time for harvesting, the berries, which drop readily when mature, are shaken from the trees upon cloths or mats spread under them. They are then piled together in heaps for forty-eight hours to soften the pulp, and afterwards put into tanks through which water flows continually, to wash off the pulp; the berries are then spread out on the platform, with which every coffee estate is furnished, to dry in the sun. But there still exists the husk, which is broken off by means of heavy rollers; the seeds are then winnowed, and put into bags for sale.

Raw coffee is roasted, after it arrives in this country, in a hollow iron cylinder, which is kept turning for half an hour over a charcoal fire until the berries are coloured sufficiently brown. Roasting coffee improves its flavour and power as a stimulant.

Coffee owes its properties to a peculiar principle, which

Hosted by Google

has been called by chemists caffeine, and which is identical both with the theine of the tea and the theobromine of the cocoa plant. It is worthy of note that the common beverages of man—tea, coffee, and cocoa—although found in the most dissimilar plants, nevertheless contain identically the same peculiar principle which gives them their nutritious and stimulating properties.

Coffee is said to have been first used by the Persians as a beverage as early as 875 A.D., and from them the Arabs learned its value. The first Arab who drank coffee was Megalledin, Mufti of Aden, in Arabia Felix, who had become acquainted with this use of the coffee berry when in Persia. The consumption of coffee was not at all rapid at first, and it was not until 1554 that it was publicly sold at Constantinople. It afterwards became very popular with the Turks, but as it frequently led to social and festive meetings, which were considered incompatible with the strictness of Mahometan discipline, its use was restricted by the Turkish Government, though without effect. In vain the Turkish priests complained to the authorities that the mosques were deserted, whilst the coffee-houses were crowded; in vain the latter were shut up by order of the Mufti, and the police employed to prevent any one from drinking coffee; the Turks found means to elude their vigilance. They would have their coffee. The law, therefore, became only a dead letter, and although never repealed, the Government acknowledged its defeat by finally laying a tax on the beverage, thus making it a source of considerable revenue.

The consumption of coffee in Turkey is very great. This is probably owing to the strict prohibition which the Moslem religion lays against wine and spirituous liquors. So necessary is coffee to the Turks, that the refusal of it in reasonable quantities to a wife is considered to be a sufficient ground for a divorce. The coffee-houses in Turkey are very numerous and some of them spacious and handsome. In

Hosted by Google

Constantinople, such as are regularly licensed are gaudily painted, and furnished with mats, platforms, and benches. Sometimes there is a fountain in the middle of the room, which renders the atmosphere delightfully cool; and also a gallery for the musicians. Towards evening these houses become thronged with a motley assemblage of Armenians, Greeks, and Jews, all smoking and indulging in tiny cups of coffee, generally drunk without either sugar or milk.

It is in the Turkish coffee-houses that the vagrant story-teller finds his stage and his audience. He walks to and fro, stopping when the sense of his story requires some emphatic expression or attitude, and generally contrives to break off in the most interesting part of his tale, making his escape from the room despite every precaution that may be taken to prevent him. His auditors thus compelled to restrain their curiosity, are induced to return at the same hour to the coffee-room. As soon as he has made his exit, the company present commence an animated discussion, in separate parties, as to the character of the drama, and the principal events of the story.

The following account, by Mr. M'Farlane, is characteristic of Turkish manners, and of the mode in Turkey of setting aside the laws in reference to coffee :—

"I was surprised to see in Smyrna, and in numerous other towns, the scarcity of coffee-houses and the quantity of barbers' shops. It was explained when, on wishing to rest awhile, my servant David led me into one of them, which in appearance was devoted to shaving, but which concealed behind a wooden screen, that looked like the end of a room, a spacious recess hung with *chibouks*, or common pipes, *narghiles*, or water-pipes, and tiny coffee-cups. The small characteristic fire for the preparation of the fragrant berry was burning in the usual corner, and there were the usual supplies of benches and stools—in short, it was a *bonâ fide* coffee-house, screened by a barber's shop, and a group of Osmanlis shuffled in after us, not to be

Hosted by Google

shaved, but to smoke their pipes and drink their cup of coffee.

"'David,' said I, 'are all these hundreds of barbers' shops nothing but veils for coffee-houses?'

"'Not all, but the greater part of them,' was the answer.

"'Yet the disguise may be easily penetrated. Any bostangi might discover the recess, and arrest a crowd of delinquents, as here, for example.'

"'That is all very true,' said David, 'but what would the bostangi get by that? The fact is, the Turks cannot live without coffee-houses; besides, the order to shut them up is now an old affair. Each proprietor may make it worth his while not to see, and so you understand the bostangi and his officers need not look beyond the barber's shop.'

"During the latter part of this speech, a Mollah, a stout advocate of both law and gospel, stepped in, and called for his narghile and coffee!"

Coffee was first sold in London in 1652, by a Turkish merchant, who kept a house for that purpose in George Yard, Lombard Street. It soon became very popular, and in 1660 a tax of fourpence on the gallon was levied on all coffee made and sold. It spread amongst the English for reasons very similar to those which caused its spread among the Turks. According to Macaulay* it extended most rapidly. To be able to spend the evening sociably at a small charge soon became fashionable. The coffee-house was "the Londoner's home." Nobody was excluded who laid down his penny at the bar. There were coffee-houses where politics were discussed, where literary men held their meetings, and where doctors, divines, and lawyers congregated, and might be consulted. "There were Puritan coffee-houses, where no oaths were ever heard, and where lank-haired men discussed election and reprobation through their noses; Popish coffee-houses, where good Protestants believed over their cups that

* "History of England, from the Accession of James II.," by Lord Macaulay, Vol. I., p. 175.—People's Edition, 1864.

Hosted by Google

the Jesuits were planning another Gunpowder Plot, and casting silver bullets, to shoot the king; and Jew coffee-houses, where the money-changers of different nations greeted each other." Such was the respectable position of a London coffee-house in 1685. Lloyd's was originally a coffee-house at which insurers and underwriters met. These houses have long ceased to be the favourite haunts of literary men and fashion, and, although still retaining their ancient name, they are now on a level with an ordinary restaurant, having been superseded as places of entertainment by the numerous music-halls and club-rooms in the metropolis, where something more stimulating than coffee is usually in demand.

Coffee, like tea, is frequently adulterated. Of these adulterations the most common one is Chicory (*Cichorium Intybus*, L.), a plant resembling a dandelion, with blue flowers, belonging to the natural order *Compositæ*. The large tap roots of this plant are sliced and dried in kilns, they are then roasted and reduced to powder, and this, when boiled, yields a drink not unlike coffee. Chicory is perfectly wholesome, containing no alkaloid or oil, and only a small amount of narcotic matter. When added to coffee in small quantities, it rather improves its flavour, neutralises its oil, and renders it less difficult of digestion. The sale of chicory is now legalised. Many persons prefer the coffee with chicory.

The adulteration of coffee with chicory is easily detected. Roasted coffee imparts its colour very slightly to cold water, but chicory colours the water a deep reddish brown. Coffee is light, and floats on the surface of the water, chicory is heavy and sinks to the bottom.

The best coffee, called Mocha coffee, comes from Yemen in Southern Arabia; Loheia and Mocha are the principal ports for its exportation on the Red Sea, besides which, Aden, acquired by England in 1838, will soon become an important coffee mart. About 4,000 tons of this coffee are annually exported. East Indian coffee ranks next in commerce, chiefly the coffees of Ceylon and Batavia. About

Hosted by Google

50,000 tons of East Indian coffee are annually produced. An inferior kind, called green coffee, is raised in the West Indies—in Jamaica, Cuba, St. Domingo, Trinidad, Guadaloupe, Porto-Rico, and Martinique,—to an annual amount of about 70,000 tons. Other American coffees also come from the free States of Venezuela and New Granada, from the Brazils, Cayenne, and Surinam. The annual produce of coffee in South America may be estimated at 81,000 tons. In 1867 about 61,486 tons were imported into the United Kingdom, principally from our foreign possessions. We export a little coffee also to our colonies and Australia. Hamburg and Amsterdam are the most important coffee markets, and next to these London, Rotterdam, Antwerp, Havre, and Trieste.

Cocoa (*Theobroma cacao*, L.; natural order, *Byttneriaceæ*). A tree, about twenty feet in height, with dark-green leaves, from four to six inches in length, and about three inches in breadth, elliptical, oblong, and pointed, the margin entire, and slightly wavy; the flowers are small and white, growing directly both from the stem and branches; the fruit somewhat resembles a cucumber; it is about five inches in length, and three inches and a half in diameter, at first green, but when ripe yellow. Within this fruit, embedded in the pulp, are from forty to fifty cocoa-beans or seeds, packed closely together in five rows, around a common centre.

The cocoa trees will only grow well in the shade. They are planted at intervals of twelve feet apart, and are protected from the fierce heat of the tropical sun by the broad-leaved banana, and the stately and beautiful *Erythrina*, or coral tree. The rays of the sun cannot penetrate the foliage of these trees, and the ground below them is constantly wet. When the fruit is ripe, it is plucked and opened; and the beans, cleared of the spongy pulp, are spread upon mats to dry in the sun.

Chocolate and cocoa are both made from these beans. Chocolate is made by first freeing the beans from their husk,

Hosted by Google

and then roasting them over a fire in an iron cylinder, with holes in its end for the escape of the vapour. The apparatus is very similar to that of a coffee-roaster. When the aroma is well developed, the beans are roasted; they are then turned out of the cylinder, and ground to a powder, which, mixed with sugar, flavoured with vanilla, and brought to a paste, forms the chocolate cakes of commerce. Cocoa is prepared by grinding up the entire nut—both husk and kernel—after roasting, a quantity of suet being added during the process of grinding. Sometimes the beans are roasted and simply crushed. This preparation is sold in the shops under the name of cocoa nibs.

The cocoa tree is a native of South America, Mexico, and the West Indies, where it formerly grew wild, but is now cultivated in extensive plantations. The beans of this tree have always been the chief means of nourishment of the natives of those countries. From them the Spaniards learnt to make both chocolate and cocoa.

The cocoa bean, which is about the size and colour of an almond, contains a peculiar solid oil called butter of cocoa, and an alkaloid called *Theobromine*, which produces on the nervous system analogous effects to those of *Caffeine* and *Theine*. Chocolate and cocoa yield highly nutritious beverages. Linnæus was so convinced of this that he called the plant *Theobroma*.

Cocoa is imported into this country chiefly in the raw state, that is, the beans with the husks on. The following are the principal sorts which are brought into Europe. The preparation, Chocolat Menier, is from cacao grown in the district of Rivas, Nicaragua. Soconusco, the best sort, from the district of the same name in the free state of Guatemala. This seldom comes into the market. Caracas, next in quality, from La Guayra, the commercial port of Caracas in Venezuela, also from Guayaquil in Ecuador. Our largest supplies come from these ports. We receive also heavy shipments from English, Dutch, and

Hosted by Google

French Guyana, the Brazils, Mexico, and the West Indies, especially from the island of Trinidad.

In 1867, 11,954,862 lbs. of cocoa were imported into the United Kingdom. Its consumption in France, Spain, and Portugal is continually increasing. Chocolate is more used in France and Spain than in England. It forms the ordinary breakfast of the Mexicans.

Both chocolate and cocoa are much adulterated with wheaten and potato flour.

GRAPE (*Vitis vinifera*, L.; natural order, *Vitaceæ*).—The wines of commerce are mostly prepared by fermentation from the juice of the grape. The vine ranks next to the tea and coffee plant in importance. The excellence of its fruit, whether fresh, or dried in the form of raisins, is well known. The virtues of its fermented juice have been eulogised in song by poets, and its excessive abuse has furnished a theme for moralists of every age and nation.

The grape varies in the colour, form, size, and flavour of its fruit. These varieties have all probably been produced by long-continued cultivation in different soils. This lengthened attention which the vine has received has given it an extensive geographical range. The vine may be found in all countries on the earth's surface included between the parallels of latitude 51° N. and 33° S. But the same latitude does not always permit the grape to ripen enough to make good wine; this depends on the average clearness or cloudiness of the atmosphere throughout the year.

The vine is generally supported by props and trellises, but in the sandy districts of Spain it is allowed to trail upon the ground. The time of the grape harvest or vintage is always regulated by the character of the wine to be made. For a brisk wine, such as champagne, the grapes are gathered before fully ripe; for a dry, full-flavoured wine, such as port, the mature grapes are selected; and for German wines, the driest of all wines, the vintage is made as late as possible. The process of wine-making is as follows:—

Hosted by Google

The grapes are gathered into baskets, which are emptied into a tub, with holes at the bottom, called the wine-press. This tub is placed over another much larger, named the wine-vat. A man then gets into the upper tub and presses or crushes the grapes by treading upon them, a mode of bruising the grape as ancient as wine-making itself. The juice, or *must*, as it is termed, flows from the press into the vat, and sometimes within a few days, or even a few hours, depending on the temperature, begins to ferment. This fermentation makes the liquor turbid, increases its temperature and volume so that it soon fills the vat. After a time the fermentation ceases, the liquor diminishes in temperature and bulk, and becomes cool and clear. When quite cold it is drawn off, or racked, as it is termed, from the vat by a tap placed a few inches above the bottom, into an open vessel, whence it is conveyed into the casks prepared for its reception. After entering the cask, a second although much slighter fermentation takes place, which further clarifies the wine; its subsidence diminishes the bulk of the wine in the cask, and more wine is added so as nearly to fill the cask. This again slightly renews the fermentation, and the cask is kept open until filled to its utmost capacity with wine free from fermentation; it is then closed and is ready for the market.

It requires great attention and practical skill to manage the fermenting process properly, as on this depends the quality of the wine. Wines vary according to the amount of sugar, alcohol, and acid which they contain. When wines contain much sugar, they are called "sweet," when little, "dry." Sweet wines, such as Malaga and Tokay, are wines which have been only half fermented; their sweetness depends on the fermentation not having exhausted the sugar. Dry strong wines, such as Madeira, Sherry, Marsala, and Port are fully fermented wines, all the sugar of the grape having been converted into alcohol. Champagne and other sparkling wines owe their briskness to the presence

Hosted by Google

of carbonic acid; whilst Hock and the Rhenish wines generally, and many of the French, contain much uncombined acid. The roughness and flavour of the red wines are usually derived from the husks of the fruit, but are often communicated to them by the addition of astringents, such as rhatany, kino, &c. The tints of wines are either natural or artificial. Their strength is frequently augmented by the addition of brandy. This brandy is itself distilled from wine. It is coloured with burnt sugar, and peach kernels are added during the distillation to give it that peculiar flavour by which it is distinguished.

The principal wine conntries in Europe are France, Spain, Portugal, Germany, Sicily, Italy, Hungary, Greece, and Turkey.

France holds the first rank. The principal French wines are white and red Champagne, white and red Burgundy, white and red Medocs from Bordeaux, Rhone wines, and wines from Languedoc, Roussillon, Orleans, Alsace, and Corsica. The inferior white wine of Bayonne, and Bordeaux wine, pass under the name of French wine, *vin ordinaire*.

From Germany we receive the celebrated Rhine wines, so called from their place of culture, the valley of the Rhine and its tributary streams; wines from the Palatinate, principally from Rhenish Bavaria; wines from the Bavarian province of Lower Franconia; Moselle wines from Rhenish Prussia; and Tauber wines from Baden and Wurtemberg. The chief places for these wines are Mayence, Coblentz, Frankfurt-on-the-Main, and Wurzburg.

The vine is cultivated to some considerable extent on the Danube in Lower Austria, also in Tyrol and Illyria; but the exportation is small. Moravia, Silesia, Bohemia, and Saxony grow inferior wines. Artificial champagne is made in many parts of Germany, especially at Esslingen, Stuttgardt, and Mayence.

The best *Swiss Wines* are the Ryff wines, from the Canton de Vaud, the *Vin de la côte* from the shores

Hosted by Google

of Lake Geneva. Of *Hungarian Wines*, Tokay is the chief, and is largely exported to Moravia, Silesia, Poland, and Prussia. Of *Spanish Wines*, Malaga and Alicante are the most valued, and called after the names of the places which export them. From Oporto in Portugal we receive red and white port wine. Numerous varieties of Italian wines come into commerce. Europe also obtains Madeira wine from the Island of Madeira, on the north-west coast of Africa, Cape (Constantia) wine from the Cape of Good Hope, and Palm wine from the East Indies. Young and inferior wines, and the lees of wine, or the sediment at the bottom of the wine-vat, are used in the manufacture of Cognac, or French brandy, and vinegar; these come into the market from Bordeaux.

In 1867 the import of wines into the United Kingdom amounted to 15,442,581 gallons.

HOPS (*Humulus Lupulus*, L.).—The hop vine, so well known in England, is a native of Europe, and is probably also indigenous in North America, as it has been found growing apparently wild on the banks of the Mississippi and Missouri. It is extensively cultivated for its strobiles or cones, so largely employed in the preparation of malt liquors. These strobiles, or female catkins, when fully ripe, are picked from the vines, dried in kilns, and packed in bags. Hops consist of thin, translucent, veined, leaf-like bracts or scales, of a greenish-yellow colour, having near their base two small, round, dark, seeds. Hops are somewhat narcotic and their odour fragrant, the taste bitter, aromatic, and slightly astringent. These properties are owing to the presence of a peculiar resinous secretion in the glands, which has been called "lupulin." Ale and porter owe their bitter flavour and tonic properties to the hops added to them during the process of brewing—about one pound of hops being added for every bushel of malt. About 550,000,000 gallons of ale and porter are annually brewed in this country. The importation of hops in

Hosted by Google

1867, chiefly from the Hanse Towns, Holland, Belgium, and the United States, was 975,168 cwts., as compared with 1,133,131 cwts. in 1860.

VI.—Plants Producing Wholesome and Nutritious Fruits.

The fruits of commerce are very numerous and interesting. They come to us from almost every climate and country; an immense amount of shipping is engaged in bringing them across the seas, and employment is thus given to hundreds of thousands of people. Besides furnishing us with nutritious food, these fruits give us much novel and interesting information in regard to the economy of vegetation in foreign countries. They are arranged naturally into two divisions:—

A. Fleshy Fruits.

Of these one of the most important is the

Sweet Orange (*Citrus aurantium*, Risso; natural order, *Aurantiaceæ*.).—This is one of our commonest foreign fruits. The orange tree is a medium-sized evergreen, with alternate, bright-green, elliptical, pellucid-glandular leaves, furnished with winged footstalks; the flowers are white and very fragrant. Both the ripe and unripe fruits are frequently seen on the tree at the same time along with the flowers—their presence amongst the foliage being truly ornamental, and adding greatly to its beauty. China is generally considered to be the native country of the orange tree, where it still grows wild. It is said to have been brought to Portugal in 1520, and thence it has been transplanted into every country possessing climate suitable for its culture. It is now grown in China, Portugal, India, Northern and Southern Africa, Southern Europe, Turkey, the islands of the Mediterranean, the Azores, the West Indies, and the Southern portion of the United States.

The oranges imported into this country come chiefly

Hosted by Google

from the Azores, Lisbon, Malta, Italy, Sicily, and Spain, in boxes and chests, and grow in those countries in the greatest profusion. It is said that a single orange tree in St. Michael's has produced a crop of 20,000, exclusive of those unfit for use, calculated at 10,000 more. In 1866, 1,711,857 bushels of oranges and lemons were imported into the United Kingdom, valued at £889,238.

The rind of the orange yields by distillation a fragrant oil much used in perfumery; a still more agreeable oil, with which eau-de-Cologne is perfumed, is distilled from orange flowers. The rind is also boiled in sugar until it is candied, and thus converted into a sweetmeat. The orange contains much saccharine matter and mucilage, forming an agreeable acid, and hence is wholesome, cooling, and refreshing to the sick, especially in cases of fever and inflammation.

THE BITTER, or SEVILLE ORANGE (*Citrus vulgaris*, L.) —This species closely resembles the sweet orange, but is easily distinguished from it by the form and bitterness of its fruit. These oranges are chiefly used in making marmalade. The rind has a place in the British Pharmacopœia from its qualities as a tonic.

CITRON (*Citrus medica*, L.).—This kind closely approaches the lemon tree in appearance, with which it has sometimes been confounded. The chief differences are its naked petiole, its greater number of stamens, and the superior thickness of the rind of its fruit. The fruit of the citron sometimes attains a very great size, weighing upwards of twenty pounds. The citron itself is not eaten, but the thick rind is much used as a preserve, and reaches England either already candied or else pickled in salt and water for the purpose of being candied on its arrival. We receive annually from Madeira about seventy tons of this preserved rind. An essential oil is readily obtained from the rind of the citron, very fragrant, and much used in perfumery.

THE LEMON (*Citrus limonum*, L.).—This plant is a native

Hosted by Google

of the Himalaya mountains. It appears to have been brought to Europe about the time of the Crusades. The lemon is now cultivated in all warm climates. The principal supplies to our markets are received from Italy, Spain, Portugal, Trieste, and South Tyrol. The juice and rind are both officinal. Lemon-juice is peculiarly grateful and cooling, and is much used in the preparation of effervescing draughts, and as a beverage in febrile complaints. The juice owes its sourness to the presence of a peculiar acid, called *citric*, which is easily separated by chemical means. It is one of the most powerful anti-scorbutic medicines known. That dreadful disease, the scurvy, has hardly been known in our navy since limes and lemons were ordered by law to be carried by all vessels sailing to foreign parts.

There are several other species of *Citrus* which are largely imported; as, for instance, the *Citrus limetta*, or lime, which is about one-third the size of a common lemon, and which is exported in the green state, in order to preserve the delightful aroma of its rind. The preserved lime comes to us in small kegs of about 7 lbs. weight. The *Citrus Bergamiæ*, or Bergamot. This bears a fruit closely resembling the lemon. As a preserve it is used as a substitute for citron, but its chief value lies in the oil obtained from it—the well-known bergamot so much used in perfumery.

GRAPES (*Vitis vinifera*, L.)—The fruit of this vine not only furnishes us with a variety of wines, but is itself exported into this country both in the fresh and the dried state. We receive comparatively few grapes in a fresh state; about 300 tons arrive every autumn from Sicily, Lisbon, and Hamburgh. They suffer in their flavour from being closely packed, and still more from the use of saw-dust as a packing material. Raisins, or dried grapes, are far more abundantly imported. These are prepared sometimes by cutting the stalks of the bunches half through, and leaving them suspended to the vine until sufficiently dry, which in this state they rapidly become, without losing

Hosted by Google

any of their fine flavour or bloom; the usual mode is to expose the grapes to the sun and air for a while, then lay them out in rooms, and sprinkle them with water in which soda or potash has been dissolved. This causes the sugar of the grape to candy, forming those little sweet lumps so well known in the common raisin. The differences amongst the raisins are caused entirely by difference in their mode of culture or curing. Thus we receive stoneless Sultana raisins from Smyrna, in Turkey; fine Muscatels, or sun-dried raisins, in bunches with the stalks still attached, from Malaga; Damascus raisins, much larger than the Sultanas, stoneless also, and preferred to the Smyrna raisins, from Damascus; and lastly, the ordinary raisins from Valencia, and from the same countries and ports where the grape is cultivated.

Currants are only the raisins of a small grape, also deficient in seeds or stones, growing in huge bunches, often as much as eighteen inches long, and of proportionate breadth. They are trod into large casks, and exported. Enormous quantities are cultivated in the Grecian islands, principally in Corfu, Zante, and Ithaca. Originally, Corinth was the principal place where they were raised, whence the name "Corinths," from which the word "currants" has been derived. In 1867, 1,002,366 cwts. of this much-esteemed fruit were imported into the United Kingdom, and about 392,322 cwts. of the other and larger varieties of raisins.

FIG (*Ficus carica*, L.; natural order, *Urticaceæ.*)—This is a very valuable and extensive genus of tropical and sub-tropical plants, some of the species attaining an enormous size, as the *Ficus Indica*, or celebrated banyan tree. The fig tree, originally a native of Asia, now flourishes in Southern Europe, on all the islands in the Mediterranean, and especially in Asia Minor, Northern Africa, and the Canary Islands.

The fig, considered botanically, is a very remarkable

Hosted by Google

form of fruit, being just the reverse of that of the strawberry, in which the minute pistils are scattered over the exterior of the enlarged succulent receptacle; whereas in the fig the inflorescence or position of the flowers is concealed within the body of the fruit. There is sometimes a failure in the fig crop, when it is not properly attended to, in consequence of the pistils of the florets not becoming duly fertilised by the pollen of the stamens. It is supposed that this operation is caused naturally by the entry of insects through the very small orifice which remains open in the flowering fig; the fig-growers therefore adopt an artificial means of ensuring fertilisation. A small feather is inserted and turned round in the internal cavity. This operation is called "caprification."

Figs are sent to us in large quantities from Turkey and Greece—those from Turkey being the best. The fig, after having been gathered from the trees and dried in the sun, is usually packed in square or circular boxes, the latter being called drums. A few bay leaves are put upon the top of each box, to keep the fruit from being injured by a grub, which feeds on it and is very destructive. The Maltese figs are very good, but those which come from Smyrna, called "Eleme," or "Elemi," are the best.

The fig is nutritious, laxative, and demulcent, acting gently in cases of habitual constipation. Roasted and split it is sometimes applied to gum-boils and other circumscribed maturating tumours. It was used by Hezekiah as a remedy for boils 2,400 years ago. (*See* Isaiah xxxviii. 21.)

The annual import of figs into the United Kingdom is upwards of 700 tons.

PRUNE (*Prunus domestica*, variety, *Juliana;* natural order, *Rosaceæ*).—Dried plums, under the names of prunes and French plums, form an important article of commerce. The prune is the Julian variety of the common plum dried in the sun; the prunes are then thrown together and

Hosted by Google

pressed into barrels. We receive them in large quantities from France. The imports in 1860 amounted to nearly 300 tons.

Prunus domestica, variety *Catherinea*, is the French plum or table prune. These are more carefully prepared for market. They generally come over in very elegant boxes called cartons, into which they are neatly packed one by one. In 1851 about ninety tons were imported.

THE DATE PALM (*Phœnix dactylifera*, L.)—This palm has been known and prized from the earliest antiquity; it is frequently referred to in the Bible. The fruit is very nourishing and wholesome, and grows in bunches weighing from twenty to twenty-five pounds. Every part of this tree is useful. Its hard wood is employed for building; its leaves are made by the natives into mats, baskets, and drinking bowls of great neatness; its seeds are ground to make oil; and its fermented sap forms an excellent wine.

In Corsica, Sardinia, and in southern Greece the date palm is planted only as an ornamental tree, as its fruit does not mature in these parts, or ripens only imperfectly. In the very warmest districts of Spain, around Valencia, the fruit comes to perfection, and is exported. The date palm is indigenous to Arabia and northern Africa, where it is very abundant. In those countries plantations of these trees are sold as estates, and are often the wedding portion of the bride. In some parts of Arabia this palm sometimes forms almost impenetrable forests when neglected by the Arab of the desert, who usually considers every kind of cultivation beneath his dignity. More frequently, however, it is found in a solitary state near a spring, thus presenting to the thirsty traveller a welcome signal, which assures him of water for refreshment, and of a friendly shade for repose.

The best dates come to us from Tunis *viâ* Marseilles. The quantity annually imported into England is from ten to twelve tons.

Hosted by Google

POMEGRANATE (*Punica granatum*, L.; natural order, *Myrtaceæ*).—A small evergreen shrub, resembling a myrtle, with numerous slender spinose branches; leaves opposite, entire, lanceolate, bright green, and sessile; flowers large, terminal, and rich crimson in colour. The fruit is about the size of a large poppy head, and similarly shaped; its rind hard, leathery, and beautifully coloured; when ripe, golden yellow, with a rosy tinge. When the rind is broken, the interior of the fruit is found to be filled with numerous seeds, each enveloped in a rose-coloured pulp, packed together in two rows, with partitions of pith between them, and closely resembling red currants.

There is scarcely a part of the pomegranate that is not either useful or agreeable. The pulp of the fruit is refreshing to persons suffering from fever. The seeds and flowers dried form a valuable medicine, and are used in dyeing, and the rind is employed in tanning and preparing the finer kinds of leather, as the morocco, so much used for binding books.

The pomegranate is a native of northern Africa, Syria, and Persia, but it is now naturalised in the warmer parts of Europe, the West Indies, and the Southern States of the American Union. It was well known to the ancients, is mentioned by Homer, and frequently referred to in the Bible. We receive annually a considerable number of chests of pomegranates from Portugal, and sometimes from Barbary. This tree is frequently cultivated as much for the beauty of its flowers and foliage as for its fruit.

TAMARIND (*Tamarindus Indica*, L.; natural order, *Leguminosæ*).—This is a large tree, with spreading branches, and abruptly pinnate leaves, the leaflets closing in the evening or in cold, moist weather, like those of the sensitive plant. The flowers are in simple racemes, the petals yellowish, variegated with red veins; these are succeeded by an oblong, compressed, one-celled, brittle, brown pod, from three to four inches in length, which encloses from

Hosted by Google

six to twelve brown, flattened, hard, polished seeds, enveloped in a soft pulp, the whole being held together by a number of thick root-like fibres which penetrate it in all directions.

The tamarind is common in the East Indies, where it is indigenous, and grows in great perfection. It is now introduced and extensively cultivated in the West Indies and in South America; but the fruit there is not equal to the East Indian, having much less saccharine matter in the pulp. The tamarinds from the East Indies are darker, have a larger and sweeter pulp, and can be preserved without sugar; those from the West Indies require sugar, and are sent over preserved in a thick saccharine syrup.

The tamarind pods are gathered when ripe, a fact known by their brittleness; the fruit is removed from the pod, placed in layers in a cask, boiling syrup is poured in, and when the cask is filled, and its contents have cooled, it is headed down for exportation.

In tropical countries the tamarind is much esteemed for its cooling qualities; its taste is acid and agreeable, and it assuages thirst. Tamarinds are principally employed in this country to form cooling medicinal drinks. Large quantities arrive annually from the East and West Indies.

BANANA (*Musa sapientum*, Tournef.; natural order, *Musaceæ*).—This may be called a stemless plant, for its gigantic leaves, with their long petioles, are sheathing and imbricated at their base, and form, by their union, a spurious trunk, often many feet in height. The leaves are from four to six feet in length, rounded at each end, and about eighteen inches in breadth throughout their whole extent; they have a strong mid-rib, parallel, lateral veins, and are of a beautiful emerald green colour. The flowers are spathaceous, and produce large clusters of succulent indehiscent fruits, each fruit being an inch in diameter and about six inches in length. When ripe, the banana acquires a

Hosted by Google

rich golden yellow colour; the outer envelope or exterior of the fruit is easily removed; the inner portion consisting of a rich cream-coloured pulp, containing much sugar and starch. The banana forms an important article of food in the tropics. Some idea of its fruitfulness may be gathered from the statement of Humboldt, that the same space of ground which will grow thirty pounds of wheat, or ninety-nine pounds of potatoes, will afford 4,000 pounds of bananas. Those intended for exportation are generally gathered green and unripe, but soon acquire, on being kept, that golden tint which marks maturity. Several other species of *Musa* produce similar fruits. *Musa paradisiaca* yields the plantain, a fruit bearing a close resemblance to the banana, and equally nutritious.

PINE-APPLE (*Ananassa sativa*, Lindl.; natural order, *Bromeliaceæ*).—This is a stemless plant with rigid, re-curved, channelled, and spinose leaves. The fruit is called in botany a *sorosis*, and consists of a union of the ovaries, floral envelopes, and the succulent axis of the inflorescence, which become pulpy and confluent with each other. The fruit is so acid in the wild state that when eaten it removes the skin from the lips and gums; cultivated, it becomes sweet and richly aromatic.

Originally indigenous to the Bahama and Bermuda Islands, the pine-apple, owing to its value as a fruit, and its capability of becoming naturalised, is now cultivated, not only in the East Indies and Africa, but in all parts of the world where it can be grown either by natural or artificial means. Owing to the introduction of steam navigation, vessels can now bring ripe pine-apples from the West Indies to England in pretty good condition; and their importation has become an extensive trade, more than 200,000 having been brought from the Bahamas in 1851. Consequently, this fine fruit is often sold in London and other large towns at a cheap rate compared with the price asked for those grown in English hot-houses. English-grown pine-apples are worth

Hosted by Google

from ten to twelve shillings per pound, whilst those imported rarely exceed half a crown for the whole fruit.

B.—Nuts

HAZEL NUT (*Corylus Avellana*, L.; natural order, *Cupuliferæ*).—This familiar edible nut is found growing wild in the United Kingdom, in the forests of all parts of temperate Europe, and in many places in Asia. The consumption is immense, especially amongst children; and many thousand bushels are annually brought to this country from Spain, Sicily, Smyrna, and other places. The filbert is only an improved variety of the common hazel nut, and although occasionally imported, is usually cultivated in sufficient quantities in England to supply the demand.

WALNUT (*Juglans regia*, L.; natural order, *Juglandaceæ*). This fine tree is too well known to need description. It grows not only in England, but over the whole of Europe, and in Asia. It is especially abundant in Circassia, where it is extensively cultivated. There is a considerable number of English walnuts in the market, as the fruit ripens well in the southern parts of this country. We receive about 30,000 bushels of foreign walnuts annually, chiefly from Germany, France, and Italy. Walnuts will not bear a long voyage without being kiln-dried, a process which certainly spoils them.

HICKORY and PECAN NUTS.—We receive from the United States, in small quantities, the hickory nut (*Carya alba*, Nutt.), and the pecan nut (*Carya olivæformis*, Nutt.), both of which belong to the same natural order, Juglandaceæ. These nuts have kernels very similar to those of the walnut, but their shells are very different. The hickory nut is smooth, whitish, marked on its exterior with three or four elevated ridges, extremely hard, and smaller than the walnut. The pecan nut is about the size of an olive, which it resembles in shape, as implied by its specific name; its colour is a light reddish-brown.

Hosted by Google

BRAZIL NUT (*Bertholetia excelsa*, Humboldt; natural order, *Lecythidaceæ*).—Large fine trees, often 120 feet in height, and growing abundantly in the Brazilian forests. The nuts are closely packed in a hard woody capsule, to the number of twelve or twenty. This capsule is nearly round, but slightly pear-shaped, and is so hard and heavy that when it is ripe it is dangerous to pass under the trees, for a human head is not thick enough to escape fracture if it be struck by one of these fruits in falling. The capsules open at the top by a circular lid, and are allied to the so-called monkey-pots. Sometimes, as soon as the falling capsule strikes the ground it bursts open, and this is at once the signal for an amusing scramble amongst the monkeys, who, keeping sentinel on a hundred branches, instantly swing themselves from tree to tree by the help of their prehensile tails, until they arrive at the spot, and then fight furiously for the coveted nuts. The Indians, in order to obtain the nuts, pelt the monkeys with stones, who in return gather the capsules to hurl at their opponents. In this manner large quantities are collected and transferred to boats, and thence to vessels. We receive from the Brazils annually not less than 50,000 bushels of these nuts.

CHESTNUT (*Castanea vesca*, L.; natural order, *Cupuliferæ*).—The chestnut tree is a native of Great Britain and the temperate parts of Europe, but the nuts not coming to much perfection in this country, we import nearly all of them from Spain, whence they are usually called Spanish chestnuts. Upwards of 50,000 bushels are annually imported. Although not very nutritious, chestnuts are much more easy of digestion when roasted. The larger and better sort called Marones are the produce of Italy, France, Switzerland, and of some parts of Germany.

THE SWEET ALMOND (*Amygdalus communis*, L.; variety, *dulcis*; natural order, *Rosaceæ*).—The almond tree, a native of the warm parts of Asia, and of the coasts of Barbary, is now cultivated to some considerable extent in Southern

Hosted by Google

Europe, especially in Italy and Spain. It grows to about the size of a common plum tree. The cortex or outer envelope of the fruit is not succulent like the peach (*Amygdalus Persica*, L.), to which the almond is allied, but hard, green, and juiceless, so that when growing it looks not unlike an unripe apricot; when fully ripe this green covering splits, and the almond in its rough shell drops out. There are two well-marked varieties of the sweet almond. 1. The Jordan almonds, the finest and best of the sweetest variety; these, notwithstanding their Oriental name, we receive from Malaga, imported without their shells. 2. The Valentia almonds, which are broader and shorter than the Jordan variety, and usually imported in the shell. England receives annually about 500 tons.

BITTER ALMOND (*Amygdalus communis*, L.; variety *amara*). —This variety comes to us from Barbary, in Northern Africa, where it forms a staple article of trade. It is principally used for its oil, which imparts a pleasant flavour to confectionery. This almond is smaller and much rounder than the two preceding varieties of sweet almond, and very bitter to the taste. The annual imports amount to about 300 tons.

Natural Order Palmaceæ, or the Palm Family.

The palms, next to the cereal grasses and sugar-cane, are the most valuable order of food plants. They are, however, of far greater importance in the countries where they are produced than in our own, furnishing as they do to the inhabitants of those countries food, shelter, and clothing. The most useful plant of this order is:—

THE COCOA-NUT PALM (*Cocos nucifera*, L.).—This palm supplies the natives of the countries in which it grows with clothing, food, medicine, houses, and every description of domestic utensil. The aspect of the tree is very imposing. Its stem is tall and slender, without a branch, and at the top are seen from ten to two hundred cocoa-nuts, each as large as a man's head; over these are the gracefully drooping, green,

Hosted by Google

glossy, and beautiful fronds. "The blessings it confers are incalculable. Year after year the islander reposes beneath its shade, both eating and drinking of its fruit; he thatches his hut with its boughs, and weaves them into baskets to carry his food; he cools himself with a fan plaited from the young leaflets, and shields his head from the sun by a bonnet of its leaves; sometimes he clothes himself with the cloth-like substance which wraps round the base of the stalks, whose elastic rods, strung with filberts, are used as a taper. The larger nuts, thinned and polished, furnish him with a beautiful goblet, the smaller ones with bowls for pipes; the dry husks kindle his fires, their fibres are twisted into fishing lines and cords for his canoes. He heals his wounds with a balsam compounded from the juice of the nut, and with the oil extracted from it embalms the bodies of the dead. The noble trunk itself is far from being valueless. Sawn into posts it upholds the islander's dwelling; converted into charcoal it cooks his food; and supported on blocks of stone, rails in his lands. He impels his canoe through the water with a paddle of the wood, and goes to battle with clubs and spears of the same hard material."*

The cocoa-nut palm grows by the sea-side in most tropical countries, and is usually the first plant to establish itself on the newly formed coral reefs in the Pacific and Indian oceans. It is abundant throughout the South Sea Islands. The fibrous outer covering of the nut, when macerated and prepared, is termed "coir," a substance much used for making ropes, mats, and stuffing for cushions (see p. 201). Large quantities of oil are obtained from the nut, after it has been ground into a rough meal, called in Ceylon, *coperah*. This oil has of late years been in great demand in England for the manufacture of composite candles and soap. Marine soap, so called because it washes linen with sea-water, is made from cocoa-nut oil. This nut is used largely in confectionery. The cocoa-nut forms a considerable

* Melville's "Adventures in the South Seas."

Hosted by Google

article of export from many of our colonies; 3,500,000 were exported from Ceylon in 1847, whence coir and coperah are also largely shipped.

VII.—Miscellaneous Food Plants.

Onion (*Allium cepa*, L.; natural order, *Liliaceæ*).—The onions of Spain and Portugal and the south of France, are superior to our common garden onion, larger, and more succulent; we, therefore, import them from those countries in chests and boxes to the amount of about 700 or 800 tons.

Soybean (*Soja hispida;* natural order, *Leguminosæ*).—A sauce or catsup, as thick as treacle and of a clear black colour, called Soy, which is much esteemed, is made from the beans of this plant by the Chinese, and sent to us from India in considerable quantities. From 500 to 600 gallons are annually imported.

Truffles (*Tuber cibarium;* natural order, *Fungi*).—These remarkable fungi grow beneath the soil, generally in beech woods, in this country somewhat sparingly, but more plentifully in France and Italy. The truffles of commerce, besides the above species, include several others, all of which are edible, and highly prized for their delicate flavour. In form the truffle is round, its surface in some species smooth, in others warted and tuberculous; the colour, dark brown outside, and brown, grey, or white within. They generally grow at the depth of five or six inches. Dogs are trained to scent them out, and sows are also employed for the same purpose. We receive them from France and Italy preserved in oil. They are used generally in sauces and soups, and as stuffing for poultry.

Morel (*Morchella esculenta*, Dill.).—This is one of several fungi found in this country which may be eaten with safety. The stipes or stalk is hollow, from two to three inches high; the pileus or cap is spheroidal, hollow within, and marked on the surface with numerous areolæ resemble a honeycomb in structure; the colour whitish.

Hosted by Google

The morel is usually found abundantly where trees have been burnt, a fact which led in Germany to the practice of firing the forests for the sake of the morels, a practice so injurious that it became necessary to suppress it by law. This fungus occasionally occurs in woods and orchards in England, whence it finds its way to our markets; it is very valuable for cookery purposes, but is more frequently used in a dry state for sauces than when fresh. We import morels from Italy.

CARRAGEEN OR IRISH MOSS (*Chondrus crispus;* natural order, *Algæ*).—This is a very common plant on the rocky coasts of Ireland and Great Britain. The frond is tufted, fixed to the rock by a hard scutate base, dichotomous, the segments linear wedge-shaped, frequently crisped and curled at the edges. The whole plant looks like yellow parchment.

Carrageen or Irish moss is sold by all druggists and herbalists in the United Kingdom. It contains an abundance of mucilage, and is extensively used for feeding cattle, and for forming a light nutritive jelly for invalids, nearly the whole weight of the plant being convertible by boiling into the required substance. Carrageen moss is sometimes used in manufactories for dressing silks. Immense quantities of it are annually brought to England from the Irish coast, and from Northern Europe.

SECTION II.—INDUSTRIAL AND MEDICINAL PLANTS.

I.—TEXTILE PLANTS, OR PLANTS FROM WHICH WE DERIVE CLOTHING AND CORDAGE

WE are indebted to the vegetable kingdom for clothing as well as food. At what time man first discovered the means of forming articles of clothing from the fibre of plants is not known, but the practice is very ancient. It was understood in the time of the Pharaohs, more than 1600 years before Christ. Flax is thus alluded to in Genesis xli. 42 :—

Hosted by Google

"And Pharaoh took off his ring from his hand, and put it upon Joseph's hand, and arrayed him in vestures of fine linen." It is not improbable that flax was cultivated even in pre-historic periods. It formed both the garments and grave clothes of the inhabitants of ancient Egypt; for the microscope shows that the cere-cloth which envelopes the Egyptian mummies, consists of the fibre of flax. We, therefore, place it first on our list of textile plants, as the one of which we have the oldest historic record.

COMMON FLAX (*Linum usitatissimum*, L.; natural order, *Linaceæ*).—This plant is a smooth fibrous-rooted annual, about two feet high, with sessile, alternate, lanceolate leaves and terminal blue flowers, in corymbose panicles. Ovary globular, five-celled, each cell containing two smooth, oval, brown, and glossy seeds.

Flax has a very remarkable geographical range, thriving in the temperate, sub-tropical, and even tropical regions. It is not only cultivated in the United Kingdom, but in every part of Europe, in Egypt, and in India. Formerly every rural family in England cultivated as much flax as was required for domestic purposes; now the spinning wheel has been superseded, and both linen and cotton goods are manufactured by steam machinery in the greatest abundance, in every variety of pattern, and with much less time and labour.

To obtain the fibrous or woody tissue of flax, the plants, after flowering, are first pulled up, dried in the sun, collected, and then soaked in water to destroy their green outer bark. This process is called water-retting, the word retting being a corruption of rotting. The tough fibres of the stalks are thus set free, are again dried, and then scutched or beaten with a heavy wooden instrument, which completes their separation. After this they are heckled, or drawn through the combing apparatus, next bleached, and, lastly, handed over to the spinner.

From flax so prepared, coarse linen fabrics are manufactured; but the flax must be heckled several times through

Hosted by Google

much finer combs to render it fit for the manufacture of fine linen, lawn, or lace. Tow consists of the rough and broken fibres detached from the skeins during the combing process. Linen when scraped is termed lint, in which form it is very valuable to the surgeon as a dressing for wounds.

About 1,547,598 cwts. of flax, dressed and undressed, were imported into the United Kingdom in 1866, chiefly from Russia, Egypt, Turkey, Italy, Belgium, and Holland. We also raise flax largely ourselves, especially in Ireland, where it is one of the staple commodities.

HEMP (*Cannabis sativa*; L.; natural order, *Urticaceæ*). — The hemp-plant is a tall, roughish annual, with a stem from five to ten feet in height, and digitate leaves, with five to seven linear-lanceolate, coarsely-toothed leaflets. The flowers are green and inconspicuous, in compound racemes or panicles, and monœcious, that is, the stamens and pistils are in separate flowers on the same plant. The seed is produced in great abundance, and is used for feeding small birds. The fibres of the stem are much longer and stronger than those of flax, and when separated and prepared (in a manner very similar to that adopted with flax, and already described) constitute the hemp of commerce, from which sail-cloth, sacking, and every variety of cordage are manufactured.

The hemp-plant is a native of Persia and of the northern parts of India, whence it has been introduced into Europe, where it is now extensively cultivated, especially in Russia. Like flax, hemp has a very extensive geographical range, growing in almost any country and climate. It thrives admirably in North America and in Africa, and is found both in a wild and cultivated state from Northern Russia to tropical India.

When growing in warm countries the value of the hemp is much diminished, and another quality is developed—it becomes powerfully narcotic, and its leaves, flowers, and stem become covered with a peculiar resinous secretion

Hosted by Google

called *churrus* in India. By the Arabs this resin is called *hashash*, and during the Crusades, men intoxicated purposely with it, called "hashasheens," used to rush into the camp of the Christians to murder and destroy, whence our word assassin is derived. Hemp is employed in other forms besides churrus as a narcotic. The whole herb, resinous exudation included, is dried and smoked under the name of *gunyah* or *bhang*, when the larger leaves and capsules only are employed. The Hindoos of British India, and the Bushmen of Southern Africa, smoke these preparations in rude pipes, as we do cigars and tobacco. These pipes are about three inches in length, and are usually made out of the tusk or canine tooth of some animal, perforated quite through, leaving only the enamel. The general effects of tropical hemp on the system, when smoked, are alleviation of pain, great increase of the appetite, and much mental cheerfulness.

From experiments made with churrus, it would seem that the fakeers and other religious devotees of India, are indebted to it for their ability to perform some of their wonderful feats. One of these experiments is thus described by Dr. O'Shaughnessy*:—"At two P.M. a grain of the resin of hemp was given to a rheumatic patient; at four P.M. he was very talkative, sang, called loudly for an extra supply of food, and declared himself in perfect health; at six P.M. he was asleep; at 8 P.M. insensible, but breathing with perfect regularity, his pulse and skin natural, and the pupils freely contractile on the approach of light. Happening by chance to lift up the patient's arm, to my astonishment I found it remained in the posture in which I placed it. It required but a very brief examination of the limbs to find that the patient had, by the influence of this narcotic, been thrown into that strange and most extraordinary of all nervous conditions, genuine *catalepsy*. We raised him to a sitting posture, and placed

* "Popular Economic Botany," by T. C. Archer, page 153.

Hosted by Google

his arms and limbs in every imaginable attitude. A waxen figure could not be more pliant or more stationary in each position, no matter how contrary to the natural influence of gravity on the part: to all impressions he was meanwhile almost insensible." Similar results were obtained from experiments on animals. After a time the influence of the drug ceases, and the patient recovers without having received any injury either in body or mind from its effects.

The narcotic hemp of warm climates was, owing to its peculiarities, thought to be another species, but it is now known only to be a variety, and is distinguished as *Cannabis sativa*, variety, *Indica*.

The imports of hemp into the United Kingdom in 1866 were 982,634 cwts., chiefly from Russia, Hungary, Austrian Italy, the Philippine Islands, and British India. The best Hungarian hemp comes from the district of Peterwardein, under the name of Sclavonian hemp. From Italy we receive, in small quantities, a remarkably fine variety, raised by spade culture, called "Italian garden hemp."

In addition to sail-cloths and cordage, a coarse brown paper is made from hemp. Oakum consists of tarry hemp, procured by untwisting old worn-out ship ropes, and is a most invaluable substance to the ship's carpenter, who uses it as stuffing with which to stop any leakage in the vessel during the course of the voyage.

COTTON WOOL (the woolly covering of the seeds of several species of *Gossypium;* natural order, *Malvaceæ*).—Much uncertainty prevails amongst the best botanists as to the number of species of *Gossypium* which furnish cotton. Linnæus has described five, Lamarck eight, Wildenow ten, and De Candolle admits of thirteen. The cotton of commerce, which consists of the hairs attached to the seeds, and is therefore cellular tissue, appears to be derived mainly from three species, designated as the cotton herb (*Gossypium herbaceum*, L.), the cotton shrub

Hosted by Google

(*Gossypium Indicum*), and the cotton tree (*Gossypium arboreum*).

1. COTTON HERB (*Gossypium herbaceum*, L.).—The greatest amount of cotton is derived from this species, which is the best known and most widely spread. It is an annual, and cultivated in the United States, India, China, and many other countries. It grows from three to four feet in height, having sub-cordate, three to five-lobed, alternate leaves, and pale yellow flowers resembling those of the mallow; the stamens are monadelphous, or united into one bundle by their filaments, and the pistil has a three-celled ovary.

After the plant has done flowering, a capsule is formed which is surrounded by the calycine and involucral leaves. This capsule grows to about the size of a walnut, turns brown as it ripens, and then dehisces or opens, displaying in its three-celled interior a snow-white or yellow down enveloping each of the three seeds lying in each cell; altogether, nine cotton balls may be collected from each capsule, each ball with its enclosed seed being about the size of an ordinary grape.

Chinese Nankin cotton is manufactured from a variety of this plant. The yellowish brown colour of the nankin is not artificially produced by dyeing, but is the natural colour of the cotton from which it is fabricated.

2. THE COTTON SHRUB (*Gossypium Indicum*, Lamarck).—The cotton shrub is cultivated in India. It closely resembles the former plant in many respects, but it grows from eight to twelve feet high; its flowers change from white to red, and its capsules are ovoid. The cotton shrub is cultivated in all countries where the cotton herb is found. In the West Indies this plant lives from two to three years, in India and Egypt from six to ten; where the climate is excessively hot, it is long-lived.

3. THE COTTON TREE (*Gossypium arboreum*).—The cotton tree inhabits India, China, Egypt, the coast of Africa, and some places in America. It grows from fifteen

Hosted by Google

to twenty feet high, and its flowers are red. It yields a variety of cotton of a very fine, soft, silky nature, which is used by the Hindoos for making turbans.

The cotton-plant is usually cultivated in fields, and treated as an annual. It is grown from seed which is placed in the ground in holes, sufficiently wide apart to allow for the growth of the plant. The plants are carefully tended until they flower, which is usually eighty days from the time of sowing. The flowers, which are handsome, either yellow or red, and not unlike those of the garden hollyhock, are suceeded by capsules, which, when ripe, open, and the cotton-covered seeds in their interior are immediately removed by the cultivator before the wind is able to scatter them. These cotton seeds are then sent to a mill, where by means of a peculiar apparatus called a *gin*, the cotton is separated from them; they are then either kept for sowing again, or as material for the manufacture of oil and oil-cake for cattle.

Cotton comes to this country in packages called bales. The word bale is applicable to any kind of goods packed in cloth and corded with rope. The average weight of each bale is 336 lbs.

In 1866, 4,098,601 bales of cotton, weighing 12,295,803 cwts., were imported into the United Kingdom. The value of this cotton in the raw state was £77,521,406, and its value when manufactured into cotton fabrics, £232,564,218. Of these fabrics we exported to the value of £60,865,022, the remainder being retained for home consumption. The spread of the English spinning and weaving machines, and the substitution of the power-loom for the hand-loom, has caused such an amount of prosperity to the cotton trade, that it is now one of the most important branches of our foreign commerce.

In business, foreign cotton is separated into the following varieties :—

North American or United States Cotton. — This is

Hosted by Google

produced in the states of Georgia, South Carolina, Alabama, Mississippi, and Louisiana. The best American cotton, which is, in fact, the best known in the market, is the celebrated Sea-island cotton, which grows on a row of islands situated along the coast of Georgia. The principal ports for the exportation of United States cotton are Charleston, New Orleans, Mobile, and Savannah.

South American Cotton.—This comes into the market from the Brazils, Guayana, Columbia, Venezuela, New Granada, and Peru. Almost all the West India Islands, too, produce cotton, and indeed of a superior quality, preferable even to the Brazilian.

East Indian Cotton.—This is very inferior to the North American, although British India, next to America, furnishes the largest quantity. The silk is very short, and not adapted to European machinery, which is framed for working the finer American long cotton. This cotton is raised chiefly for exportation to China. Recently a better staple has been produced in India from American seed, and already a considerable quantity has been exported to England. East Indian cotton comes in little bales, very strongly compressed and corded, which are carried on the backs of camels, or on wagons, to the Ganges, and there received into boats with capacious interiors; these descend the river, and take the cargo to European ships. The East Indian sorts known in commerce are the Bengal, Madras, Bombay, Surat, Siam, and Manilla cottons.

Levant Cotton.—This includes all the cotton which is received from ports in European and Asiatic Turkey, as well as from the Morea and the Archipelago. Like that from British India, it is of inferior quality. The principal sorts are the Smyrnian, Syrian, Cyprian, Macedonian, and Persian cottons. Most of the last is consumed in Persia, excepting some small quantities, which go to Russia *viâ* Astracan.

African Cotton.—Excellent cotton is received from the

Hosted by Google

French island of Bourbon; Egyptian cotton has also greatly improved in quality recently, because the crops have been raised from American seed. The best African cotton is, however, grown in Algeria, and is remarkable for the beauty of its colour, the fineness of its silk, the care taken in harvesting the crop, and the good condition in which it appears in the market. The long silk cotton of Algeria partakes at the same time of the character of the long silk staple of Georgia, and the short cottons of Egypt, and approaches in quality the finest Louisiana variety. Algeria is capable—if the necessary encouragement is given—of producing the finest cotton in the world.

The value of cotton in commerce depends on the length and strength of the silk or staple. Cottons may be divided into the long silk and short silk. The United States generally furnish the short silks in the greatest quantity, with the exception of one sort, known as the Georgia long silk, or Sea-island cotton, of which the production elsewhere is very limited. Cotton threads are numbered from 1 to 300, according to the degree of fineness to which they are spun. In weaving, the cross threads or woof are shot by the machine across or at right angles to threads extending longitudinally, called the warp. Long silk cotton is generally spun into the threads for the warp, and the short silk is used for the woof.

The chief seats of the cotton manufacture in the United Kingdom are Manchester, Bury, Oldham, and Glasgow. Most of the many thousands of cotton-mills give employment to from fifty to even 1,500 hands, presenting the most perfect order in every department. All these persons are employed by means of the fine white silky hairs with which the Creator has clothed the seed of the cotton plant, in order to effect its dispersion, and which the ingenuity and skill of man now manufactures into clothing for many millions of the human race.

JUTE, or GUNNY FIBRE, is the produce of *Corchorus*

Hosted by Google

capsularis, L. (natural order, *Tiliaceæ*), an annual, growing from twelve to fourteen feet high.

The fibre which is contained in the bark is generally about eight feet in length, and is obtained by treatment very similar to that adopted with the flax and hemp plants. Jute fibre is fine, and has a remarkable satiny lustre, so that it is sometimes mixed with the silk in the fabrication of cheap satins, and is very difficult to detect in the goods. Its chief use, however, is for making coarse canvas, or *gunny*, as it is called in India. Rice, oil-seeds, dye-stuffs, cotton, and sugar, are all sent to us from India in gunny bags or bales. When wet, jute fibre quickly rots, so that it is not adapted for the manufacture of either sail-cloth or cordage; but notwithstanding this, it is often mixed with hemp for the latter. The quantity imported in 1869 was 2,500,000 cwts.

NEW ZEALAND FLAX (*Phormium tenax*, Forst.; natural order, *Liliaceæ*).—A coarse growing plant, with long narrow leaves, the slender fibres of which glisten like silk, and are white as snow. Its flowers are of a brownish-red colour, and not at all ornamental.

This plant inhabits the marshes of New Zealand, but grows well in any soil; and in mild climates, such as the south of France, winters in the open air. It affords a fibre of great strength, stronger than hemp, which is extracted by maceration, drying, and heckling, as in the case of the other products. Good ropes can be made from the coarser, and very fine linen from the finer fibres. The quantities imported are at present inconsiderable, owing to the circumstance that the strength of the fibre is injured by maceration. No machinery has yet been contrived which can approach or even imitate the dexterity of the native women in separating the fibre from the coarser parts. New Zealand flax fibre will not bear a cross strain, and, therefore, cannot be tied into a knot without breaking.

COIR-FIBRE (*Cocos nucifera*, L.; natural order, *Palmaceæ*).

Hosted by Google

—This fibre is obtained from the outer husk of the cocoa-nut. It is stronger than hemp, and more capable of withstanding the action of water. It is separated from the husk by beating, and then cleaned by heckling in the usual manner. The coir-fibre thus procured is spun by the natives of India and Ceylon into yarns of different length and thickness, which are largely exported to Europe. The yarn on reaching this country is manufactured into ropes, door-mats, and floor-mattings, which are far more durable than those made from bristles. In India, coir-fibre is very generally used for ship-cordage and fishing-nets. In 1850 about 10,661 tons were imported into London and Liverpool, chiefly from Ceylon and Bombay.

CARLUDOVICA PALMATA, L. and P. (natural order, *Pandaneæ*).—This species of screw pine is terrestrial, and bears fan-shaped glabrous leaves from six to fourteen feet long, and four feet in breadth. It ranges from 10° N. to 2° S. latitude on the American continent.

Panamá hats, which are distinguished from all others by consisting of a single piece, as well as by their durability and flexibility, are so named because they are shipped through Panamá, though a large proportion are manufactured in Guayaquil, Ecuador. The finest hats are made in South America with fibre of the unexpanded leaf, called "torquilla," from which are also made very fine hammocks.

The leaves are gathered before they unfold, all the ribs and coarser veins are removed, and the rest, without being separated from the base of the leaf, is reduced to shreds. After having been exposed to the sun for a day, and tied into a knot, the straw is immersed into boiling water until it becomes white; it is then hung up in a shady place, and subsequently bleached for two or three days. The straw *(paja)* is now ready for use, and in this state is sent to different places, where the Indians manufacture from it, hats, hammocks, and those beautiful cigar-cases which cost as much as five and six pounds a-piece. The plaiting

Hosted by Google

of the hat is done on a block, which is placed upon the knees; it is commenced at the crown and finished at the brim. According to the quality of the hats, more or less time is occupied in their completion; the coarser ones may be finished in two or three days, the finest take as many months.

The average export from Guayaquil has been in the past six years from 15,000 to 16,000 dozens annually, the price varying from two to 130 dollars, according to fineness. Lately the leaves or raw material have been in demand for export, the average quantity shipped being about 200 to 250 cwts. annually.

These hats are also made in Veraguas, Western Panamá, Costa Rica, and New Granada. The petioles of the leaf are made into baskets, called *petacas*, the fibre being variously dyed.

MANILLA HEMP (*Musa textilis*, Tournef.; natural order, *Musaceæ*) produces a woody fibre, which is used in India in the manufacture of fine muslins; the most exquisite textile fabrics, and the elegant Manilla hats are manufactured from it.

II.—OLEAGINOUS PLANTS, OR PLANTS YIELDING VALUABLE OILS.

Oil is of the greatest importance in the arts. It is extensively used for burning in lamps, for diminishing friction in machinery, for making candles and soaps, in the manufacture of paints and varnishes, and in wool-dressing—five gallons of olive, rapeseed, or other oils, being used in the preparation of every pack of wool—also as an article of food, and as medicine. Oils are distinguished into two kinds: fixed or fat oils—which are obtained by pressure from the fruits or seeds of plants—and essential oils. The fixed oils burn with a clear white light, and boil at a high temperature, about 600° F.; most are liquid at the ordinary temperature; but cocoa-nut and palm oils are solid at 50° or 60° F. All the fixed oils are nearly inodorous, and lighter than water.

Hosted by Google

The volatile, or essential oils, give off vapour at the temperature of boiling water, when mixed with water, or under 320° F. by themselves.

The following are a few of the most important plants which yield the oils of commerce :—

A. Fixed Oils.

Oil Palm is principally produced from the fruit of *Elais Guineensis*, L., a native of the western coast of Africa. The fruit is about the size of an olive, of a yellow colour, three-fourths of which consist of a yellow oily pulp. This fruit is crushed and the oil extracted from the albumen by boiling in water. Palm oil is used in England principally in the manufacture of yellow soap, but with the Africans it is an article of food. A generation ago large tracts of country along the western coast of Africa were covered by the oil palm, then little cared for, now a large foreign demand for palm oil has sprung up, and with it property in these trees; and this oil trade has stopped the slave trade on the Gold coast, where it once flourished, and at the mouth of the Niger. The average imports of palm oil into Liverpool alone have been for several years past upwards of 18,000 tons, giving employment to 30,000 people. In 1866 the palm oil imported into the United Kingdom amounted to 812,080 cwts. Industry and a desire of accumulating property are at last manifest amongst the African population, and everywhere are now to be seen on this coast the germs of a nascent civilisation.

Cocoa-nut Oil is obtained from the albumen of the kernels of the cocoa-nut (*Cocos nucifera*, L.); it is principally used for making cocoa-stearine for candles. In Trinidad and Demerara it is used by the coolie labourers as we employ butter. The imports in 1869 were 13,288 tons, almost the whole of which came from Manilla and Ceylon.

Castor Oil Plant.—(*Ricinus communis*, L.; natural

Hosted by Google

order, *Euphorbiaceæ*). This plant, in temperate climates, is a large herbaceous annual, with palmate peltate leaves, and monœcious flowers in terminal panicles, the lower male, the upper female. The capsules are prickly, globose, three-celled, with one seed in each cell. The seeds are ovate, shining, of a grey colour, marbled with black.

The castor oil plant is a native of India, Africa, and the West Indies. In warm climates it acquires a woody stem, and becomes a tree, rising in India often to a height of thirty feet. Nevertheless it is still the same plant, and not entitled to be considered as a distinct species, although a woody perennial; the leaves and flowers are unaltered, and the seed, if sown in temperate climates, produces herbaceous plants in every respect the same as those in common cultivation.

Castor oil is obtained by expression from the seeds without heat, hence it is called "cold drawn castor oil." The seeds, sewn up in horsehair bags, are crushed by the action of heavy iron beaters, and the oil, as it oozes out, is caught in troughs and conveyed to receivers, whence it is bottled for use. Castor oil is brought over from the East Indies in small tin cases closely soldered and packed in boxes, weighing about two cwts. each. In 1853, 23,597 cwts. were imported into the United Kingdom. Castor oil is much used in medicine as a mild and certain purgative.

Olive Oil (*Olea Europæa*, L.; natural order, *Oleaceæ*).—The olive tree is a small evergreen, much branched, and covered with a greyish bark. The olive itself is a drupe or stone fruit, with a fleshy covering about the size, shape, and colour of a damson. When ripe this fleshy covering contains an abundance of olive oil, which it yields by expression.

The olive is indigenous to Palestine, Greece, and the slopes of the Atlas mountains in Africa. It is now widely diffused in Europe, and is cultivated with great success in Italy, Spain, the South of France, Naples, Sicily, Southern Illyria, Lombardy, and Dalmatia.

The olives are gathered when nearly ripe, and the oil is

Hosted by Google

drawn from them by presses and mills, care being taken to set the mill-stones so wide apart that they will not crush the nut of the fruit. The pulp is then subjected to a gentle pressure in bags made of rushes, and the best or *virgin* oil flows first. A second oil, of inferior quality, but fit for table use, is obtained by moistening with water the residuum, breaking the nuts and increasing the pressure; lastly, more water is added, and the residuum is again re-pressed, the product being an impure oil, fit only for soap-making or for burning. Spanish or Castile soap is made by mixing olive oil and soda; and soft soap, by mixing fat, or fixed oil, with potash. The *marc* of olives, as the residuum is called after the oil has been expressed, is valuable either as a manure or is food for cattle.

The virgin oil is called Florence oil, and is imported in flasks surrounded by a network formed of the leaves of a monocotyledonous plant. It is used at the table under the name of salad oil. Gallipoli oil forms the largest portion of the olive oil brought to England; it is imported in casks. Olive oil is largely used in this country in dressing woollen goods, and for machinery. In 1866, 23,690 tuns of this oil were imported into the United Kingdom.

RAPESEED, the seed of *Brassica napus*, L.; natural order, *Cruciferæ*.—This plant grows wild in many parts of England, and is cultivated extensively in this country, in France, and in Germany, for the sake of the oil procured from its seeds. Rape oil is more suitable than any other oil for the lubrication of machinery, and is now much used for locomotives, marine engines, and for burning in lamps. A single locomotive consumes from 90 to 100 gallons of oil annually. The consumption of oil by the London and North-Western Railway Company alone is every year 40,000 gallons. Good English rapeseed yields an oil very superior to that obtained from foreign rape, nevertheless, in 1867, we imported 610,782 quarters of rapeseed, and about 300 tons of the oil in 1851, chiefly from France and Germany.

Hosted by Google

LINSEED, the seed of *Linum usitatissimum*, L.; natural order, *Linaceæ*.—We have already described this plant under the name of flax. Flax seed or linseed yields a most valuable oil known as linseed oil, largely employed in the arts, especially in painting and in the manufacture of printers' ink. It becomes solid on exposure to the action of the air, or in other words, is one of the drying oils. This article is always imported in the form of seed. In 1867 the imports into Great Britain were 1,095,360 quarters, principally from the East Indies and Russia. Smaller quantities came from Prussia, Germany, Egypt, and America.

SESAME (*Sesamum orientale*, L.; natural order, *Pedaliaceæ*). —This is a small showy annual, indigenous to India, and to the whole of Southern Asia, from Japan and China to the shores of the Mediterranean. In these countries it is much cultivated, and the oil, yielded in abundance by the seed, is used for dressing food, and as a common lamp-oil. In the East, this oil has some considerable repute as a softener and beautifier of the skin, and as an application to furfuraceous eruptions.

Sesame oil is without odour, and does not easily become rancid. It is frequently used for the adulteration of balsams and volatile oils. Large quantities of the seed are brought to this country from the East Indies and Egypt.

We have now noticed the principal vegetable fixed oils. There are several other oil-producing plants in the market, but not much in demand at present. The following are deserving of notice:—Croton Oil (*Croton tiglium*, Lam.) This oil is a valuable and most powerful purgative, capable in over-doses of destroying life, and only administered one drop at a time, in cases where it is of the utmost importance to make a speedy impression on the bowels, and where the patient has difficulty in swallowing. It is also valuable as a counter-irritant. Croton oil is obtained by expression from the seeds. The common hazel nut (*Corylus Avellana*, L.) yields an oil most valuable for the delicate machinery of

Hosted by Google

watches, diminishing the friction of the pinions, the axles of the wheels, and other rapidly moving parts, which would otherwise wear injuriously, and speedily become disordered. The oil of almonds also is employed for the same purpose. Other oils are obtained from cotton seed, ground nut, carthamus seed, &c.

B. Volatile or Essential Oils.

These oils occur in the stems, leaves, flowers, and fruits of most sweet-scented plants, whence they are obtained by distillation. In this respect they differ from the oils already described, which are found only in the seed, obtained by expression from the same, and do not evaporate; hence the latter have been called fixed oils. The difference between fixed and volatile oils is easily shown. A drop of any fixed oil—such as olive oil, for instance—leaves a stain on paper which is permanent; but a drop of any volatile or essential oil—as, for example, oil of bergamot—makes a similar stain, which evaporates and disappears.

To obtain essential oils the leaves, flowers, or other parts of the plant are put into an apparatus for distillation. This always consists of a boiler in which the vapour is raised, and a condenser in which it again becomes fluid. For distillation on a small scale, a common retort and receiver answer every purpose, care being taken to keep the receiver cool, by placing it in cold water. When the water boils, the steam passes through the retort into the condenser, where it is re-converted into water, the essential oil floating on its surface; this is skimmed off, and afterwards purified by filtering. But the perfume of most flowers depends on the presence of a fragrant volatile or essential oil, peculiar to the plant. When, therefore, we obtain this oil, we really get the essence of the plant, or the essential principle which makes it valuable; and although the plant may be an annual, and perish together with its fragrance in a few weeks or months, yet, if we extract the oil, we can retain

Hosted by Google

the essence of the plant as long as we please. The following are the most important of the essential oils which occur in commerce :—

OIL OF LAVENDER, from *Lavandula spicata, L. vera;* nat. order, *Labiatæ.*—Large quantities are raised at Mitcham, in Surrey; but it is also imported from France and Germany.

OIL OF THYME, from *Thymus vulgaris*, L.; natural order, *Labiatæ.*—This oil is distilled from all parts of the plant. It comes into this country from Hamburg and from the United States. Used in scenting Windsor soap.

OIL OF PEPPERMINT, from *Mentha piperita*, L.; natural order, *Labiatæ.*—Besides that raised and manufactured at home, we receive large quantities from Germany and the United States.

OIL OF ANISE, from *Pimpinella anisum*, L.; natural order, *Umbelliferæ.*—This plant is a native of the Levant, whence a great deal of the anise of commerce is derived. It is also much cultivated in France, Naples, and Germany—particularly in Thuringia and Swabia. We receive considerable importations from Germany and the East Indies; but those sorts coming from Spain, Apulia, and Malta, are considered in commerce to be the most valuable.

OIL OF CARAWAY, from *Carum carui*, L.; natural order, *Umbelliferæ.*—The best caraway oil comes from Malta, Naples, and Alicante in Spain. Small quantities are received from Germany. Much more, however, is home-manufactured and exported.

Cinnamon, clove, cassia, pimento—all yield essential oils, to which reference has already been made in treating of those spices; oil of bergamot, oil of lemons, and Neroli oil, or oil of orange flowers, have also been mentioned in connection with those fruits.

OIL OF ROSES, ATTAR OF ROSES, or OTTO OF ROSES, is distilled from the petals of *Rosa centifolia*, L., *Rosa gallica*, L., and numerous other species of rose. The attar of roses

Hosted by Google

is prepared in Persia and other Asiatic countries; but, with all the aids of science, the process still remains unknown to Europeans. Some idea of its costliness may be gathered from the fact that 100,000 roses must be distilled to yield 180 grains, or three drachms of pure attar. Five guineas have often been paid for one ounce of this essence. It is the favourite perfume of the whole civilised world, and in Oriental countries is a most essential luxury. In Cashmere the harvest of rose leaves is celebrated as the festival of the year. Its description is well known in the exquisite poetry of Moore.

III.—Tinctorial Plants, or Plants furnishing valuable Dyes.

The clothing which is furnished by the textile plants and the sheep's wool, would be of one dull uniform hue, if it were not for the valuable dyes furnished by the tinctorial plants. At first the colours of plants, when transferred to clothing, imparted only a temporary beauty; for the art of fixing them, or uniting them permanently with the cloth, by means of mordants, was unknown; but by experiments long and carefully conducted, Nature has been interrogated successfully, and we are now able to render these colours fast, or permanent, thus enriching our silken, woollen, linen, and cotton manufactures, with an almost endless variety of beautifully coloured designs. It is impossible to mention even the names of the numerous plants which furnish materials for the dyer. Only a few, and those the most common in the commercial world, can be noticed. All the parts of plants furnish these dyes; sometimes it is the root, or the wood of the stem, sometimes the leaves, flower, or fruit.

Alkanet Root (*Anchusa tinctoria*, L.; natural order, *Boraginaceæ*).—A perennial herbaceous plant with rough, oblong, lanceolate leaves, a stem about a foot in height, purplish flowers, and a long woody root, with a deep red bark. It is a native of the Levant, and is much cultivated in Germany

Hosted by Google

and the south of France, particularly about Montpelier, for the sake of the red colouring matter contained in the bark of the root, easily obtained by soaking the root in alcohol or oil. It is used for colouring ointments red, especially lip-salves; it is also employed as a dye, to colour gun-stocks and furniture in imitation of rosewood. Alkanet root comes to this country in packages, weighing about 2 cwts. each, chiefly from Germany and France. About eight to ten tons are annually imported.

SUMACH (*Rhus Coriaria*, L.; natural order, *Anacardiaceæ*). —The sumach of commerce is the crushed or ground leaves of this plant, imported from Sicily. This material is valuable for tanning light-coloured leather, and imparts a beautiful bright-coloured yellow dye to cottons, which is rendered permanent by proper mordants. In 1866 more than 13,688 tons of sumach were imported into the United Kingdom.

ARNOTTO (*Bixa orellana*, L.; natural order, *Flacourtiaceæ*). —This is a small evergreen tree, indigenous to tropical America, and now cultivated in the East Indies. It is called *Roucon* by the French, and the Orleans tree by the Germans. The first South American settlers noticed the brilliant and showy colour obtained from its berries, on the bodies of the Indians, by whom it is called "Bixa," or "Bija," and not only used it themselves, but speedily converted it into an article of commerce. The arnotto tree grows about twelve feet in height; its leaves are smooth and heart-shaped, and its pink-coloured flowers are followed by oblong bristled pods, somewhat resembling those of the chestnut, at first rose-coloured, but changing as they ripen to dark brown. On bursting open, these pods show in their interior a splendid crimson farina or pulp, in which are contained ten or twelve seeds, in colour somewhat resembling coral beads. The arnotto of commerce is prepared from this crimson pulp. By maceration in hot water the seeds are separated from the pulp, which is then made into balls or cakes of two or three pounds' weight; these, when dry, are wrapped up in large

Hosted by Google

leaves and packed in casks for exportation. Another kind—the roll arnotto—is of a much superior quality. It is a hard extract, and contains a much greater proportion of colouring matter.

Good arnotto is of the colour of fire, bright within, soft to the touch, and dissolves entirely in water. It is used in Holland for colouring butter, and in Cheshire and Gloucestershire for dyeing cheese (under the name of cheese-colouring), to which it gives the required tinge, without imparting any unpleasant flavour or unwholesome quality. Flag or cake arnotto comes from the West Indies, especially from the island of St. Domingo or Hayti. Roll arnotto is principally brought from the Brazils. The rolls are small, not exceeding two or three ounces in weight. Arnotto is also used to dye silks and cottons, especially to form the colour called aurora. It is much to be regretted that the beautiful orange and gold-coloured dyes yielded by this plant are fugitive, and become discoloured in the sun. The bark of the arnotto tree makes good ropes, available in the West Indies for common plantation uses. The imports of roll and flag arnotto into the United Kingdom in 1863 were as follows:—Roll, 761 cwts., value £2,853; Flag, 2,507 cwts.; value £10,111.

MYROBALANS (*Terminalia chebula*, L.; natural order, *Combretaceæ*).—This dye is obtained from a small tree indigenous to British India, and closely allied to the myrtle. All the species of *Terminalia* have astringent properties. The fruit and galls of this tree are very astringent, and much valued both by dyers and tanners. The fruit is about the size of a date, pointed at the ends, and of a yellowish brown. The myrobalans of commerce are probably derived from more than one species. With alum they give a durable yellow colour. Myrobalans are now an important item in our commerce. We receive them from Calcutta, Madras, and Bombay. The average annual imports are about 1,200 tons.

SAFFLOWER (*Carthamus tinctorius*, L.; natural order,

Hosted by Google

Compositæ).—Furnishes a beautiful rose-colour, which is used for silks, cottons, and the manufacture of rouge. Safflower is an annual herbaceous plant, somewhat resembling a thistle, to which it is allied. The leaves are ovate-lanceolate, somewhat spinous, alternate, sessile; flowers yellow.

The safflower is a native of the Levant, and is cultivated in China, India, and in the south of Europe. The dye is obtained from the florets. These are gathered, pressed into little cakes, dried, and then packed in strong bales, weighing about two cwts. each. As found in commerce, these cakes consist of flaky masses of a red colour, intermixed with yellow filaments, the former tint being due to the corolla, and the latter to the stamens. The flowers thus contain two colouring principles, one yellow, soluble in water, and the other rose-red, called carthamine, or carthamic acid, soluble in alkaline solutions; this latter, when precipitated from its solution, dried, and mixed with finely powdered talc, constitutes rouge. It is the carthamic acid which renders the safflower valuable as a dye.

The greater portion of the safflower imported into this country comes from Persia, Egypt, and the East Indies. The imports in 1851 were nearly 600 tons.

Logwood (*Hæmatoxylon Campeachianum*, L.; natural order, *Leguminosæ*).—A middle-sized tree with a contorted trunk, rarely more than one foot and a half in diameter, covered with ash-coloured bark; branches crooked, beset with sharp thorns; leaves pinnate or somewhat bi-pinnate, with sub-cordate leaflets; flowers yellow, in terminal racemes.

This tree, indigenous to Central America, Mexico, and Campeachy, has been introduced into the West Indies, and is now naturalised there. The heart-wood is the part of the tree employed; the generic name refers to its blood-red colour. Logwood is of very frequent use in the arts, as it forms the basis of many of the reds in printing calicoes, and is esteemed one of the best deep red dyes. It is imported

Hosted by Google

in logs, which are cut up into chips and ground to powder for the use of dyers, hatters, and printers, in powerful mills constructed for that purpose. Logwood, when boiled, communicates its own dark red colour to the water, and the addition of a few drops of acetic acid changes the colour to a bright red. Red ink is made in this way, a little alum being added to render the colour permanent. If, instead of an acid, an alkali—such as soda or potash—be added, the colour changes to a dark blue or purple, and with a little management every shade of these colours may be obtained. Logwood is so hard and heavy as to sink in water. It is used chiefly for dyeing red, blue, and black. We import every year about 40,000 tons from South America, whence a great deal also goes to Spain, France, and Germany. The principal ports for the reception of logwood are London, Cadiz, Bordeaux, and Hamburg.

MADDER (*Rubia tinctoria*, L.; natural order, *Rubiaceæ*). A small, herbaceous, perennial creeping plant; stems slender, quadrangular; leaves four in a whorl; flowers small; fruit yellow; berry double, one being abortive.

Madder is cultivated in France, Southern Europe, and the Levant, where it is indigenous, for the sake of the valuable red dye furnished by the root. The roots are dug up when the plant is about three years old, carefully dried, and packed into bags or bales for exportation. As found in commerce, madder-root is in long cylindrical pieces, about the thickness of a quill, and of a deep red or brown colour. If ground before exportation, the powder is sent in very large casks. We get madder roots whole from India, Turkey, Greece, Spain, and France; and ground from Holland and Germany. Powdered madder root is a bright Turkey red, but by the addition of suitable chemicals every shade of red, purplish-brown, purple, lilac, and even a lively rose colour can be obtained from it. Madder root imparts its red colour to water and alcohol. It is used as a basis for red dyes, as it affords a tint which, when

Hosted by Google

properly fixed by appropriate mordants, is not affected by light or moisture. Scarcely a calico or muslin print is made without the aid of madder root, in some way or other, for forming the pattern.

The imports of madder root into the United Kingdom in 1866 were 221,668 cwts.; of madder 121,563 cwts.

INDIGO (*Indigofera tinctoria*, L.; natural order, *Leguminosæ*).—A shrub from two to three feet high, with pinnate leaves, and racemes of greenish-coloured flowers, marked with vermilion red. Indigo is also extracted from two other species, viz., *Indigofera anil* and *I. cærulea.*

This plant is a native of India, whence the chief supplies of indigo are received. It is principally grown in Bengal, from the 20° to the 30° N. latitude. Indigo is also cultivated in Java, the Philippine Islands, Egypt, the West Indies, and British Honduras.

The best time for cutting the plant is when it begins to flower, because then it is always richest in its peculiar secretions. The plants, when cut, are first laid in a vat, called the steeper, about twelve or fourteen feet long and four feet deep, and filled with water. In twelve or sixteen hours the water begins to ferment, swell, and grow warm; the highest point of its ascent is marked, for when it ceases to swell, fermentation begins to abate. The manager now opens a tap to let off the water into a second vat, called the beater, and the gross sediment at the bottom of the first one is carried off and used as manure for the next crop of plants, for which purpose it is excellent. The indigo fluid received into the second vat is kept actively stirred and beaten with bamboos until it begins to granulate. When granulated sufficiently, the liquor assumes a deep purple colour, the whole being troubled and muddy. It is now allowed to settle, and as the upper part of the water clears, it is removed into other vessels, until nothing remains but a thick sediment at the bottom of the vat. This is put into gunny bags, which are hung up to drain and dry. To

Hosted by Google

finish the drying, the indigo is turned out of the bags, exposed to the sun, worked upon boards with a spatula, and put into boxes, and again exposed to the sun until fully dried, when it is ready for market.

The indigo plant grows best in the East Indies. It was first brought to Europe by the Dutch in the middle of the seventeenth century. It is now imported, every year in increasing quantities, from the East Indies, and also from both North and South America, to which it has been transplanted. Indigo is used in the dyeing-houses of our woollen, linen, cotton, and silk manufacturers, and has almost completely displaced the native woad (*Isatis tinctoria*, L.), formerly used. The finest sort comes from Bengal, *viâ* Calcutta. About 5,000 tons are annually imported; and British India has almost a monopoly of the indigo trade. The French import a very good quality from the Isle of Bourbon, and the Dutch from the Sunda Islands, in the East Indies. The best American indigo is raised in Guatemala, in Central America, and an inferior kind at Caracas, in Brazil, St. Domingo, Carolina, and Louisiana. There are extensive indigo plantations on the fertile delta of the Nile, under the management of Hindoos. Indigo has also been received recently in small quantities from Madeira, the river Senegal, and Sierra Leone.

Good indigo is known by the purity of its colour and its lightness, which is indicative of the absence of any earthy impurity. A blue carmine, made out of this substance, is a very high-priced colour, used by painters. The quantity of indigo imported in 1866 into the United Kingdom was 74,256 cwts.

TURMERIC (*Curcuma longa*, L.; natural order, *Zingiberaceæ*).—This is a stemless plant, with palmated tuberous roots of a deep orange colour internally, long-stalked, lanceolate, smooth leaves, and flowers in a central oblong green spike.

Turmeric is a native of the warm parts of Asia, and is

Hosted by Google

found in India, China, Cochin-China, Java, and Malacca, where it is extensively cultivated for the sake of the beautiful yellow dye afforded by its root, and also as a condiment, as it forms a principal ingredient in Indian curry powder. Turmeric gives a beautiful but fugitive gold colour to silks. Paper stained with turmeric is much used by chemists as a test for alkalies, which colour turmeric paper reddish or brownish. Turmeric is also used in making Dutch pink and gold-coloured varnish. There are several varieties of this dye in the market, the principal of which are the Long Turmeric (*Curcuma longa*, L.), and the Round, better known as Chinese Turmeric. In 1851 the imports of turmeric into the United Kingdom from China and India were about 2,000 tons.

QUERCITRON (*Quercus tinctoria*, Michx.; natural order, *Cupuliferæ*).—This oak grows from sixty to ninety feet high. Its leaves are six to eight inches long, obovate, deeply sinuate-lobed, pubescent beneath; the acorn small ovoid, seated in a sub-sessile cup, which tapers at the base.

This tree is indigenous to the United States, growing abundantly in Pennsylvania, North and South Carolina, and Georgia. The inner bark is an article of commerce under the name of Quercitron, and furnishes a yellow dye, which has now nearly superseded the use of our indigenous Weld (*Reseda Luteola*, L.) in calico printing. Quercitron, when crushed, resembles a mass of short yellowish-white fibres, mixed with powdery particles, and in this state is sent over in casks. From 3,000 to 4,000 tons are annually received in England from New York, Philadelphia, and Baltimore.

YELLOW BERRIES (*Rhamnus infectorius*, L.; natural order, *Rhamnaceæ*).—This plant is a species of buckthorn, and is a native of Persia, Turkey, and the south of Europe. It is a procumbent shrub, growing naturally in rough, rocky places. The unripe berries furnish a yellow dye, which is largely employed in calico printing, for dyeing morocco

Hosted by Google

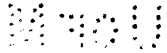
leather and paper, as well as for the preparation of sap green and Dutch pink. The largest and best yellow berries are the Persian, which come to this country *viâ* Aleppo and Smyrna; a considerable quantity is also received from France and Turkey. The importation amounts annually to between 500 and 600 tons.

FUSTIC (*Maclura tinctoria*, Nutt; natural order, *Urticaceæ*). A large and handsome evergreen tree, growing in the West Indies and tropical America. There are large forests of this tree in the Antilles, especially in Jamaica, Cuba, Porto Rico, and Tobago. Fustic is brought to market in long pieces or logs. The beautiful yellow and red veined is the best. Fustic dyes yellow, olive, brown, maroon, bronze, and Saxon green. The quantity imported into England in 1851 was 9,808 tons.

WOAD (*Isatis tinctoria;* natural order, *Cruciferæ*).—Woad is much cultivated in France, Normandy, Alsace, and also in Germany, where it was in use a thousand years ago. It is indigenous to England and Germany. The blue matter of this plant is contained in its leaves. Woad was used by the ancient Britons to stain their bodies. The extensive use of East Indian indigo has greatly restricted the cultivation of woad, but as the dyers very unwillingly dispense with it, on account of its cheapness, and the durability of its colour, it is probable that indigo will never entirely supersede its use.

NICARAGUA or PEACH WOOD (*Cæsalpinia echinata;* natural order, *Leguminosæ*).—This dye wood gets its name from the Republic of Nicaragua in Central America. It reaches this country in blocks about four feet in length and eight inches in diameter. It dyes a delicate peach and cherry colour, and is much used. We receive annually about 8,000 tons. That which comes from Peru yields the finest shades of colour.

Several other species of *Cæsalpinia* yield dye woods. Thus *Cæsalpinia crista* furnishes the Brazil wood, and *Cæsalpinia Brasiliensis* the Brazilletto wood, which yields



Hosted by Google

some very fine rose-coloured, yellow, and orange-red dyes, according to the mordants used. About 800 tons of the first, and 400 tons of the latter, annually arrive in England from the vast forests of South America, which are very rich in dye woods. Brazil wood is imported principally from Pernambuco, and is also known by the name of Fernambuk wood in allusion to the place of importation. Besides its usefulness as a dye wood, it also serves for objects of art; bows of violins are especially made from Fernambuk wood.

SAPAN WOOD or BUKKUM WOOD (*Cæsalpinia Sapan*) furnishes another good red dye, which is used extensively both in India and Europe. About 3,670 tons were imported into England in 1850 from the East Indies.

RED SANDERS WOOD (*Pterocarpus santalinus*, L.; natural order, *Leguminosæ*) yields a dye of a bright garnet red colour, and is chiefly employed for dyeing wool. The tree which produces the wood is a lofty one, common about Madras and other parts of India. The exports of this wood from Madras in one year only, have been nearly 2,000 tons. We import also usually between 700 and 800 tons a year from Calcutta and Bombay.

ORCHELLA WEEDS (*Roccella tinctoria*, *R. fuciformis*, and *R. hypomecha*, L.; natural order, *Lichenes*).—These lichens, which constitute the orchils of commerce, are of an ash-grey colour, having a thallus much branched, flattened, and mealy in appearance, from one inch and a half to two inches in length. The blue dye known under the name of archil or orchil is prepared from these plants, which grow on all the rocky coasts and islands of the Mediterranean, and also in the Canary Islands, Madagascar, Cape of Good Hope, and South America. The colour yielded is not in itself a fast one, but it so greatly improves others that orchil is regarded as indispensable by the dyers. The imports into this country are about 600 tons per annum.

THE TARTAR LICHEN (*Lecanora tartarea*, L.), indigenous to Sweden, Norway, and England, answers the same purpose.

Hosted by Google

Litmus paper, so much used by chemists as a test for acids and alkalies, is prepared from the blue dye furnished by this lichen. Whole cargoes of it are annually brought from Sweden to Holland, where its dye, called cudbear, is the most skilfully prepared, and therefore called Dutch blue.

IV. Plants furnishing valuable Building and Furniture Woods.

A. Timber.

The cultivation of wood is now carried on in several countries in Europe, where the population is considerable and the natural forests have disappeared; above all, Germany is to be distinguished for forest culture. But most wood, especially for ship-building, is still procured from those countries where the natural forests remain—viz., from Russia, Norway, Sweden, Canada, and the United States. In Germany, vast quantities of wood are annually floated down the rivers Rhine, Maine, Neckar, Weser, and Elbe, from the still productive woods of Thuringia, the Hartz, Fichtel, and Erz mountains, and the Black Forest. Russia exports a considerable amount of wood to England and the south of Europe, from St. Petersburg, Riga, Archangel, and from the Russian ports of Odessa and Cherson, on the Black Sea. Much timber is also exported to the South of Europe from Drontheim, Bergen, and Christiana, on the coast of Norway; from Göttenberg, a port in Sweden; and from Dantzic, Konigsberg, and Stettin, Prussian seaports on the Baltic. American timber is exported to the United Kingdom chiefly from Canada *viâ* Quebec, which is a great depôt for wood. The importation in 1867 of timber and wood was:—Not sawn or split, 1,211,042 loads; sawn or split, 2,177,549 loads; and staves, 62,625 loads.

Of forest productions the following deserve to be mentioned as sources of considerable trade:—

Mahogany (*Swietenia mahogoni*, L.; natural order, *Cedrelaceæ*) occupies the highest rank amongst the furniture

Hosted by Google

woods. This is one of the loftiest and most gigantic trees of the tropics. It is indigenous to the West Indies and Central America. The mahogany tree is cut down in April and May, which is the height of the dry season; it is then squared by the adze, the branches being lopped off; and about the middle of June, when the rivers are swollen by the rains, the logs are placed on trucks and drawn by bullocks to the water-side; there they are launched into the river, formed into rafts, and so floated down the stream to the vessels awaiting their arrival.

Spanish mahogany is imported from Cuba, St. Domingo, and the Spanish Main, in logs twenty-six inches square and ten feet long. Honduras mahogany is usually lighter than the Spanish, and is imported in logs four feet square and eighteen feet long. Mahogany is chiefly valued for its colour, firmness, and durability, and the beautiful polish which it is capable of receiving. On account of these and other excellent qualities, it is particularly suitable for ship-building. Mahogany is light and buoyant, free from dry rot, and does not warp; it also suffers less from the action of shot than any other wood; since shot, when received by it, generally remains fast in the wood without splitting it.

Mahogany is extensively used in the manufacture of the best articles of domestic furniture, fancy and ornamental wood-work, cabinet-making and veneering; in fact there are, comparatively speaking, but few persons who have not this wood constantly before their eyes, in some form or other of useful home furniture. The quantity of mahogany imported into the United Kingdom in 1866 was 53,458 tons.

EBONY (*Diospyros ebenus*, L.; natural order, *Ebenaceæ*).—This tree is a native of the Mauritius. As soon as felled the timber is immersed in water from six to eighteen months; it is then taken out, and the two ends are secured from splitting by iron rings and wedges. Mauritius ebony is imported in round sticks, like scaffold poles, about fourteen

Hosted by Google

inches in diameter. It is much used for inlaying and turnery.

A great deal of ebony comes into commerce from the Cape of Good Hope, and arrives in England in sticks of about three to six feet long, and two to four inches thick.

EAST INDIAN EBONY (*Dalbergia latifolia*, L.; natural order, *Leguminosæ*).—The real raven black ebony, one of the heaviest and hardest of all woods, and which in the fineness of its texture resembles ivory, is derived from this tree, which is indigenous to the island of Ceylon, and is also found in Java, Sumatra, and the Manilla Islands. This ebony is used for wind instruments and the keys of pianos.

The alburnum, or sap-wood of both the mahogany and ebony trees is white and valueless, and is chipped off with the adze before the logs are shipped. The indurated heart-wood of these trees is the only part of the stem fit for industrial and economic purposes.

BOXWOOD (*Buxus sempervirens*, L.; natural order, *Euphorbiaceæ*).—This is an evergreen shrub, a native of Southern and Western Europe. The wood is dense, compact, and admirably suited for wood engravers and also for the formation of graduated scales and fine works of art. It is imported in pieces four feet long and ten inches in diameter, from Smyrna, Constantinople, and the Greek Islands. The fine saw-dust of this wood is sold at Nuremberg and other places as pounce, which dries writing quickly. Annual imports between 3,000 and 4,000 tons.

SANDAL WOOD (*Santalum album*, L.; natural order, *Santalaceæ*).—This tree, producing the beautiful and perfumed sandal-wood, is a native of India and China. Sandal-wood is much used for entomological cabinets, as its fragrance is a preservative from insects. In China it is employed as incense, and is manufactured into toys. The shavings and saw-dust of sandal wood are valuable in perfumery.

LIGNUM VITÆ (*Guiacum officinale*, Plum.; natural order,

Hosted by Google

Zygophyllaceæ).—This is the hardest and heaviest wood known. It is of a dark olive colour, and cross-grained, the fibres running obliquely into one another, in a form somewhat resembling the letter X, so that it cannot be split with an axe, and is therefore divided by the saw. The tree is forty feet high, and four or five feet in circumference, with numerous knotted, much divided branches, abruptly pinnate leaves, and bright blue flowers. It grows in tropical America, especially in Jamaica, where it is very abundant, and whence our supplies are chiefly obtained. The timber of this tree is very valuable, where strength and durability are needed and weight is no object. Lignum vitæ comes over in billets about three feet in length and a foot in diameter, and is chiefly used for ship-blocks and pulleys. It takes a fine polish, and turns well, and for this reason is used by turners for articles requiring a hard close-grained wood.

Bird's-eye Maple (*Acer saccharinum*, L.; natural order, *Aceraceæ*).—This tree is a native of North America, where it grows from Canada to Georgia. In early spring it yields, when tapped, an immense quantity of sugar. The beautiful wood known as bird's-eye maple, so much admired in cabinet work, is obtained from this species.

American Cedar (*Cedrela odorata*, L; natural order, *Cedrelaceæ*), a native of the West Indies and Central America. This tree furnishes the wood used for the boxes in which cigars are packed, and for the inside portions of furniture.

Pencil Cedar (*Juniperus Bermudiana;* natural order, *Coniferæ*).—A North American tree, which furnishes the red wood for lead pencils.

Lance Wood (*Duguetia Quitarensis*, St. Hilary; natural order, *Anonaceæ*).—This tree furnishes lance wood, which is used by coachmakers for the shafts of gigs and other vehicles where both strength and elasticity are required We receive lance wood from Cuba and Guiana, whence it

Hosted by Google

comes in the form of poles fifteen to twenty feet in length and six to seven inches in diameter.

ROSEWOOD (*Triptolemœa* and *Dalbergia;* natural order, *Leguminosæ*).—Several undetermined species of these genera of trees furnish rosewood. We receive this wood from Brazil, in planks about twelve feet in length, flat on one side and rounded on the other, each being evidently one half of the stem, with the bark removed. Violet wood and king wood, which come to this country also from the Brazilian forests, are probably only other species of the same plant, as both resemble the rosewoods. They are in much smaller pieces, usually in round sticks four or five feet long and from two to six inches in diameter. The best rosewood comes from Rio de Janeiro, and has recently been ascertained to be chiefly the timber of *Dalbergia nigra.* Rosewood is much used for library and drawing-room furniture, and is so named because, when fresh, it has the odour of a rose. The imports into England in 1863 were 2,120 tons.

BLACK WALNUT (*Juglans nigra*, L. ; natural order, *Juglandaceæ*).—This is a large tree, indigenous to North America. Previous to the introduction of mahogany and rosewood, walnut was held in high estimation in the manufacture of costly furniture. It is still imported for furniture, although to a less extent than formerly, and is now chiefly employed in the manufacture of the stocks of all kinds of fire-arms.

SNAKEWOOD (*Piratinera Guianensis;* natural order, *Artocarpaceæ*).—This is a very beautiful ornamental wood, of a rich chestnut brown colour, mottled with cloudy amber-coloured spots, resembling the markings of serpents—a scarce wood, imported from South America in sticks, two or three inches in diameter, and five or six inches in length. When dry, snakewood readily takes fire if rubbed against wood harder than itself, and is so used for obtaining fire by the native Indians.

SATIN WOOD (*Swietenia chloroxylon* L. ; natural order, *Cedrelaceæ*).—This is a handsome, hard, yellow veneering

Hosted by Google

wood, occasionally imported from India, the West Indies, and South America, in logs seven or eight inches square and ten feet in length. It is used by cabinet-makers and upholsterers in inlaying work, and for picture frames.

The far greater proportion of our building timber consists of the wood of various coniferous trees, which we import from America, Northern Europe, and Switzerland. The deal used in carpentry is the wood of several species of pine and fir. Thus, white deal is furnished by the Norway spruce fir (*Abies excelsa*, L.); yellow deal by the Scotch fir (*Pinus sylvestris*, L.); the silver fir (*Abies picea*, Link.) furnishes a whitish deal much used for flooring. There are numerous others, as the American and European larches (*Larix Americana*, Michx., and *L. Europœa*, L.); the hemlock spruce fir (*Abies Canadensis*, Michx.), which are employed for ship and house building. We can only mention them, and we must now leave this branch of our subject, as we have not space for further selection. The names only of the trees—European, Asiatic, African, American, and Australian—which yield valuable furniture and building materials, would form quite an extensive catalogue.

V. Plants producing valuable Gums, Resins, and Balsams.

The substances now to be considered are distinguished as follows :—

Resins are the inspissated or thickened juices of plants, and are commonly associated with an essential oil; they are insoluble in water, but are dissolved by alcohol and essential oils.

Gum Resins or *Balsams* are partly soluble in water, from the quantity of gum they contain.

Gums are soluble in water, but not in alcohol.

Balsam Fir (*Abies balsamifera*, Michx.; natural order, *Coniferæ*).—This tree furnishes the Canada Balsam so much

Hosted by Google

used in mounting microscopic preparations of objects of natural history, as it not only preserves, but at the same time gives them transparency. This oleo-resinous fluid is contained in blisters of the bark, which are punctured, and the balsam is then caught as it exudes. Imported from America.

INDIA-RUBBER, GUM-ELASTIC, or CAOUTCHOUC, is the hardened milky juice of many euphorbiaceous plants and others. That from the Brazils is the produce of *Siphonia elastica* (Rich.), a noble tree, growing to a height of sixty feet, with a light, stone-coloured bark. That collected in Central America, and now an important article of export all along the Atlantic seaboard, is obtained from *Castilloa elastica.* The Brazilian method of obtaining the caoutchouc, or India-rubber, is to spread the milky juice upon clay moulds, and dry it in the sun or in the smoke of a fire, which blackens it. The moulds are in the form of balls, bottles, and shoes. The juice is collected from incisions made in the stem, and is received into a cup of clay placed under the wound. It flows freely, to the extent of about four ounces daily, from each tree. This juice is then smeared over the clay moulds in successive layers, which are dried separately, until a sufficient number have accumulated to give a proper thickness; the clay is then washed out, and the india-rubber is ready for the market.

In Central America the juice is collected from incisions made in the stem, and is received into vessels. A tree four feet in diameter will yield twenty gallons of juice, each gallon producing two pounds of good dried rubber; and an industrious man will collect twenty-five gallons a day. The milky juice is strained through a wire sieve, so as to exclude all impurities before it is transferred to barrels, in which the real manufacture of the rubber is performed. The best manner of converting the milk into rubber is by mixing with it the juice of a certain vine, termed by the natives *achuca,* which has the singular property of pro-

Hosted by Google

ducing coagulation within the space of five minutes. About a pint of the infusion of the vine is well mixed with every gallon of the milk. This is done in a large tin pan, and the rubber separates as a soft mass from the brown liquid. This mass is then placed on a board, slightly pressed by hand, and rolled out with a piece of heavy wood. A great quantity of water is thus squeezed out, and the rubber, which has now assumed its elasticity, is made into flat round cakes a quarter of an inch thick, twenty inches in diameter, and perfectly white in colour.

Hitherto the greater portion of the caoutchouc imported has been received from South America, but latterly a considerable amount has come from Singapore, Assam, and other places in the East Indies. This is the product of the *Ficus elastica*, L., having close affinity to the famed banyan tree, so celebrated for its pillared supports, "whose daughters grow about the mother tree," and which has furnished the motto "*Tot rami quot arbores*" to the Royal Asiatic Society. But this product is nevertheless very inferior to that furnished by the Brazilian india-rubber tree.

Caoutchouc is contained in the juices of many tropical trees, and in small quantities in many plants of temperate regions; it seems to form an essential part of the milky juices which are characteristic of the *Euphorbiaceæ*, *Apocynaceæ*, and *Urticaceæ*.

In 1864, 71,027 cwts. of caoutchouc were imported into the United Kingdom in the raw state—viz., from South America, 52,097 cwts., valued at £389,576; and from the East Indies, 11,930 cwts., valued at £113,069. The same year, our exports of caoutchouc to Europe and the United States were 29,107 cwts., valued at £205,932. The total import for 1867 was 79,756 cwts.

GUTTA-PERCHA (*Isonandra gutta*, Hook.; natural order, *Euphorbiaceæ*.)—This is a magnificent tree, sixty or seventy feet in height and from five to six feet in diameter, growing in the Malayan archipelago. Gutta-percha is the inspis-

Hosted by Google

sated juice of this tree, and is procured as follows:—The trees are felled, the bark removed, and the milky juice which is found between the bark and wood is collected and poured into a trough made from the stalk of the plantain-leaf. It quickly coagulates on exposure to the air, and is then kneaded into cakes for exportation.

Gutta-percha is one of the most valuable vegetable productions ever discovered. It is in its natural state hard, rough, dry, opaque, tough, inflammable, and slightly soluble. On immersion in hot water it becomes softened and capable of being moulded into any figure, which it retains when cold; a number of pieces, too, may be united so perfectly as to show no mark whatever of their junction. It is not elastic, but so tough that a thin slip, one-eighth of an inch in substance, will sustain a weight of forty-two pounds. A great variety of articles are made from gutta-percha, and, above all, cables for the conveyance of the submarine telegraph, which, without this invaluable substance, could not have existed.

The demand for gutta-percha is continually increasing, and it is certain that a process too destructive to the trees is adopted in the endeavour to furnish the requisite supply.

In 1864 the gutta-percha imported amounted to 36,750 cwts.; and, at the very lowest estimate, not fewer than 300,000 trees were destroyed to obtain that amount. A short time ago this tree was abundant on the island of Singapore; now few if any other than small plants are to be found there, all the large trees having been felled. The range of its growth appears, however, to be considerable, as it doubtless extends over all the islands of the Malayan archipelago; and happily several other sources are known.

TAR (*Pinus sylvestris*, L.; natural order, *Coniferæ*).—Tar is an impure turpentine, viscid, and brown-black in colour, procured by destructive distillation from the roots of various coniferous trees, particularly the above species. This process was known to the ancients, being described by Theophrastus, and is nearly the same now as in his time.

Hosted by Google

A bank is chosen near a marsh or bog, as the roots of pines so situated always yield the greatest supplies of tar; in this bank a conical cavity is formed, the sides of which are beaten down and rendered as firm as possible with heavy wooden mallets. A cast-iron pan is placed at the bottom of the hole or funnel, with a spout which projects through the side of the bank, and barrels are placed beneath this spout to collect the tar as it comes away. This cavity is then filled with the roots of the pine, which are cut and neatly packed so as to fill up the entire space, and the whole is covered over with turf and beaten down with the mallet or stamper. The roots in the inside of the cavity are then set on fire, and the tar, as it distils, runs down the sides into the iron pan, passing through the spout into the barrels, which, as fast as filled, are bunged, and are then ready for exportation.

Tar is used chiefly by seamen, for preserving cordage and wood from the effects of the atmosphere. Nearly all our tar comes from Russia, Norway, and Sweden; the United States, also, supply us with a considerable amount; the forests between Bayonne and Bordeaux in France, the Black Forest, and the forest of Thuringia, in Germany, send large quantities into commerce. In 1869, 33,500 tons of tar were received into this country.

Pitch is tar condensed or deprived of the more volatile parts by distillation. The tar is boiled in an open iron pot until all the volatile matters are driven off; the residuum remaining is pitch. This is a black, solid, and glossy substance, very brittle when cold, but softening and becoming ductile when heated. That used in this country is mostly home manufactured. Pitch is frequently mixed with tar, and used for similar purposes, in ship-building, for caulking the seams of vessels, &c.

TURPENTINE PINE (*Pinus palustris*, Wild., and *Pinus Tæda*, L.; natural order, *Coniferæ*).—The importation of turpentine by other nations is not very considerable, since almost

Hosted by Google

every country possesses trees from which it may be procured. England, however, is an exception, the demand for turpentine being much greater than the home supply. We receive nearly all our turpentine from the United States, and it is obtained from the above two species of *Pinus*. There are also in the market, Bordeaux turpentine, obtained from *Pinus pineaster*, Aiton; Strasburg turpentine, from *Abies pectinata;* Venice turpentine, from *Abies larix* (Rich.), the common larch; and Chio turpentine, from the *Pistacia terebinthus* (L.), a tree indigenous to Cyprus.

The process of collecting turpentine is in each case nearly the same. The bark of the tree being wounded, the turpentine trickles out in drops into boxes or other vessels placed so as to receive it. The incisions are made about the close of the month of March, and the turpentine continues to flow throughout the vegetative season, particularly during the summer months.

Turpentine is imported in barrels, weighing from two to two and a half cwts., and has the appearance and consistence of honey. Oil or spirits of turpentine is obtained by distillation from the raw turpentine; the residue is the common resin or rosin of the shops. Spirits of turpentine, as a solvent of all resins, is much used in the preparation of paint and varnish; and rosin in the manufacture of common soap, common sealing-wax, for the bows of violins, and for caulking ships.

In 1863, 27,343 tons of turpentine, valued at £31,274, were imported into the United Kingdom, chiefly from North America.

GUM-ARABIC (*Acacia vera*, Wild., and *Acacia Arabica*, Wild.; natural order, *Leguminosæ*).—Gum-arabic is produced by these two trees, which grow in abundance in Arabia, and in Egypt on the banks of the Nile. It flows spontaneously from their trunks and branches, in the form of a mucilage, which dries and hardens on exposure to the air. The more sickly the tree, and the hotter the weather, the

Hosted by Google

more abundantly exudes the gum. It is very nutritious, and the Arabs who gather it almost live upon it during the harvest.

The principal African and Arabian ports for the exportation of gum-arabic are Aden, Mokha, Suez, Cairo, and Alexandria. Gum-senegal, the product of *Acacia Senegal*, (Wild.), is the best and dearest sort of Arabian gum. It is distinguishable from gum-arabic by its clearness, consisting of choice drops or tears, some as large as a pigeon's egg, entirely white, and shining like glass. Gum-tragacanth, which is yielded by *Astragalus tragacantha*, L., is also considerably in demand, and is one of the chief gums of commerce. We receive this gum from Greece and Asia Minor. The principal place for its exportation is Smyrna.

These gums are chiefly used in the manufacture of silks, crapes, and muslins, to stiffen and glaze the fabric; they are employed also in calico-printing, to give consistence to the colours; in medicine, painting, and in the manufacture of ink. The quantity imported in 1850 was 1,984 tons, of which 328 tons were gum-senegal.

GUM-SANDARACH (*Callitris quadrivalvis*, Verst.; natural order, *Coniferæ*).—This tree is a native of Barbary, on the African coast. The Turks construct the ceilings and floors of their mosques of its wood, which is all but indestructible. The gum, which is much used in making fine varnishes, is imported to the extent of from twelve to fifteen tons annually.

GAMBOGE (*Hebradendron gambogioides*, Grah.; natural order, *Clusiaceæ*.)—Gamboge is a gum-resin obtained from this tree, which grows wild on the Malabar and Ceylon coasts. In Ceylon gamboge is obtained by wounding the bark of the tree as soon as the flowers begin to appear. It appears in commerce in three forms—in solid rolls or cylinders, in hollow rolls or pipes, and in amorphous masses or cakes Gamboge is imported from Ceylon, Siam, and Cochin-China. The best is the pipe-gamboge from Siam.

Hosted by Google

Gamboge is employed as a water-colour or pigment by artists, also in medicine as a drastic purgative. Our imports were—in 1863, 388 cwts., valued at £3,268; and in 1864, 42 cwts., valued at £520.

CAMPHOR TREE (*Laurus camphora*, L.; natural order, *Lauraceæ*).—The camphor tree is a native of China, Japan, Borneo, and the island of Formosa. Camphor—a gum-resin—is obtained as follows:—"The wood of the *Laurus* is cut into small pieces, and put, with plenty of water, into small iron boilers, which are covered with an earthen dome lined within with rice straw. As the water boils the camphor rises with the steam, and attaches itself as a sublimate to the stalks, under the form of granulations of a grey colour. In this state it is picked off the straw, and packed up for exportation to Europe."*

Camphor is brought to this country in chests, drums, and casks—in small granular, friable masses, of a dirty white or greyish colour. It is much used in museums and private collections of natural history, as a preservative of animal and vegetable bodies against the depredations of insects. It is also used in medicine, in the composition of varnishes, and in the manufacture of fire-works. The total amount annually received from China and Japan is about 466,000 lbs.

FRANKINCENSE (*Boswellia Carterii*, &c.; natural order, *Amyridaceæ*).—This is an odoriferous gum-resin, much used by the Roman Catholics in their churches. It was employed by the priests of ancient Egypt to conceal the unpleasant emanations arising from the sacrifices offered in their temples. It is imported from India and the Levant.

ASAFŒTIDA (*Narthex asafœtida*, Falconer; natural order, *Umbelliferæ*).—This fetid gum-resin exudes from incisions made in the roots of the plant. It is first a milky juice, but when dried in the sun, acquires a mottled appearance and a pink colour. The plant is indigenous to the south of Persia,

* Ure's "Dictionary of Arts, Manufactures, and Mines." Vol. 1. London, 1867.

Hosted by Google

Affghanistan, and the Punjaub. Asafœtida usually comes over in casks and cases. It is much used in medicine as a valuable stimulant and anti-spasmodic, in cases of asthma and spasmodic cough.

VI. The Barks of Commerce.

Many varieties of bark are known in commerce, the chief of which are those used for medicinal purposes, such as the Peruvian and Cascarilla barks; and those which are employed in the arts and manufactures, or economic barks, such as the bark of the cork oak, and the valuable tanning bark of the common oak.

Medicinal Barks.

Peruvian Bark (*Cinchona Condaminea*, Humb. and Bonpl., &c.; natural order, *Cinchonaceæ.*)—Peruvian bark is the product of various species of Cinchona, a group of evergreen trees and shrubs growing on the slopes of the Andes in Peru and Bolivia, at elevations varying from 7,000 to 10,000 feet above the level of the sea.

The medicinal properties of this bark are entirely owing to the presence of three alkaline and bitter principles, quinine, cinchonine, and quinidin, which are the most effective remedies known against intermittent and allied fevers. The Jesuit missionaries were the first to discover and make known its value as a remedial agent, and for a long time they were the sole vendors of it, whence its name of "Jesuit's Bark." The generic name *Cinchona* was given to the plant because, in 1638, the Countess of Chinchon, wife of the Viceroy of Peru, was cured of intermittent fever by its use; hence, also, the powdered bark was called *Pulvis Comitissæ*, or Countess's powder.

There are, at the fewest, twelve species of *Cinchona* from which the Peruvian bark of commerce is derived. All these resemble each other in their general features; having opposite leaves, which are shining, lanceolate, on short

Hosted by Google

petioles, and small, tubular, and white or rose-coloured flowers, arranged in ample panicles at the extremities of the branches. The principal varieties of Peruvian bark recognised in the Pharmacopœia are the *pale*, the *yellow*, the *red*, and the *crown* bark. Pale or *grey* bark, is obtained from *Cinchona nitida* and *C. micrantha;* Loxa or crown bark, from *C. Condaminea;* yellow or Calisaya bark is yielded by *Cinchona Calisaya;* the source of the red bark is *C. succirubra.* The pale bark contains most cinchonine, the yellow most quinine; Loxa or crown bark the largest proportion of quinidine; the red yields the alkaloids in about equal proportions.

Peruvian bark comes to us in the form of quills or hollow cylinders, which vary in length and diameter, the longest seldom exceeding two feet—the diameter varying from a quarter of an inch to two inches. These quills are the bark of the smaller branches of the tree, which rolls up thus as it dries in the sun. Pale bark arrives in quills only; the Calisaya or yellow bark, and also the red bark, come both in quills and flat pieces, which last are derived from the trunk, and reduced to this form by being alternately exposed to the sun and then subjected to pressure until perfectly dry. Peruvian bark is usually imported in packages, or *serons*, made of dried cow-hides. The annual imports into this country amount to between eighty and ninety tons. The cinchona plant has been introduced with every prospect of success into British India, where large plantations are now established in many of the hilly districts; and more recently into Japan and the Mauritius.

Cascarilla Bark (*Croton Eleutheria;* natural order, *Euphorbiaceæ*).—This tree is a native of St. Domingo, the Antilles, and the Bahama Islands. Its bark is imported chiefly from Eleuthera, one of the Bahamas, and comes in small-sized quills and in chips. Cascarilla bark has strong aromatic and tonic properties, and is an excellent remedy in chills and fever, being occasionally employed as

Hosted by Google

a substitute for cinchona. When burned it gives forth a sweet musky odour, and is often used in fumigations. The amount annually received in this country is from ten to twelve tons.

CEDRON (*Simaba cedron*, Aubl.; nat. ord., *Simarubaceæ*). —The cedron is a small tree confined to the republic of New Granada, ranging from about the fifth to the tenth degree of north latitude. Every part of the plant, but especially the seed—owing to the presence of an alkaloid (*cedrine*)—is intensely bitter. On account of this principle, it is used extensively, and with considerable success, in cases of intermittent fever. But the chief reputation of the cedron rests upon its being considered an efficacious antidote for the bites of snakes, scorpions, centipedes, and other noxious animals; and so highly do the natives of the land in which it grows value it, that they will pay a large price for a single seed.

QUASSIA AMARA, belonging to the same order as the cedron, is also a valuable febrifuge.

VII.—TANNING MATERIALS.

In the bark of certain trees a peculiar light yellow glistening substance exists, called *tannin*, or tannic acid, which consists of small yellow crystals. This tannic acid has the power of combining with the gelatine in the skins of animals, and converting them into leather by forming a tannate of gelatine. The most valuable bark for this purpose is that of

OAK (*Quercus pedunculata;* natural order, *Cupuliferæ*). —Indigenous to this country, and also much cultivated. We import large quantities of oak bark from Holland and Belgium. In 1869 we received 25,000 tons, whilst the home produce was 250,000 tons.

VALONIA (*Quercus ægilops*).—Under this name the acorn-cups of this species of oak are used; although the tree is dwarf and shrubby, these cups are very large and much

Hosted by Google

prized by tanners. Large quantities are imported from the Levant, chiefly *viâ* Smyrna, not less than 29,396 tons having been received in 1866. Sometimes these acorns are gathered before they are fully formed; they are then called *camata*, or *camatina*. In this state they are more valuable, but too expensive to be largely employed.

NUT-GALLS (*Quercus infectoria*).—This tree abounds in Asia Minor. The galls are excrescences upon the young twigs, produced by the punctures of an insect, a species of *Cynips*. The market is chiefly supplied from the ports of the Levant, whence they are called Aleppo galls. They contain much tannin and gallic acid, and are largely employed both in tanning and dyeing. We receive nut-galls from Turkey, Greece, the Ionian Islands, Hungary, and Sclavonia, *viâ* Vienna, Trieste, Leghorn, Genoa, and Marseilles. One kind, called the *knoppern*, is distinguished from the smooth gall-nuts by many angular and rough excrescences, as well as by having the essential principles in greater strength.

DIVI-DIVI (*Cæsalpinia coriaria;* natural order, *Leguminosæ*).—This tree is a native of the salt marshes of Curaçoa, Carthagena, and other places in South America. It furnishes in abundance a brown pod, about the size of that of the pea, but curved into the form of the letter S. This pod is very astringent, and therefore of great value in tanning. The Indian name, divi-divi, has been adopted by our merchants. It is not used alone, but is generally mixed with oak-bark and valonia. In 1851 more than 3,000 tons were imported.

CATECHU (*Acacia catechu;* natural order, *Leguminosæ*). A thorny tree; a native of Hindostan. Catechu is procured by cutting the wood into chips, boiling them, and then straining the liquor, and evaporating it until it assumes the appearance and consistency of tar. This substance hardens as it cools, is formed into small squares, dried in the sun, and is then fit for market. Catechu contains a large proportion of tannin. Packed in mats, it is sent to

Hosted by Google

this country in large quantities from India. Several varieties of it are known to merchants by the names of catechu, terra japonica, cutch, and so forth. Dissolved in water, it tans skins very rapidly—one pound of catechu being equivalent to seven or eight of oak bark; but the leather is not so durable or good as that which is more slowly prepared from oak bark.

Betel-Nut Palm (*Areca catechu*, L.) grows in most parts of the East Indies. The trunk is straight and slender, and from forty to fifty feet in height; the fruit is about the size and shape of a small egg, and the nut itself rather larger than a nutmeg, roundish-conical, and brown in colour.

The betel-nut furnishes an astringent extract, which constitutes one or more varieties of the catechu of commerce. But the principal consumption of the betel-nut is for chewing, in combination with the pepper leaf of the *Chavica betel* and lime. For this purpose, the nuts are divided into quarters, one of which, rolled in the pepper leaf and sprinkled with lime, forms the quantity generally used. This mixture gives a red tinge to the saliva, and seems to have some narcotic power. It is in general use as a masticatory amongst the natives of the East Indies, much the same as tobacco in other countries.

VIII.—Plants Remarkable for their Narcotic and Poisonous Properties, yet useful as Remedial Agents.

Opium (*Papaver somniferum*, L.; natural order, *Papaveraceæ*).—The poppy is an annual plant growing from two to four feet high, having flowers with two sepals and four white petals, with a violet spot at the base of each petal. Stamens numerous; pistil, a globular ovary or capsule, surmounted by a radiated stigma, containing partial dissepiments and numerous seeds.

The opium poppy is a native of Persia, and probably also of the south of Europe and Asia Minor. It is largely

Hosted by Google

cultivated in those countries, and also in Egypt, Arabia, and British India, for the sake of its opium. Dr. Joseph Hooker thus describes this process :—"The capsules are sliced in February and March with a little instrument like a saw, made of three serrated plates tied together. From the incisions made by this instrument the opium oozes out as a milky juice, which as it dries becomes a soft brown sticky paste; each morning this paste is scraped off by means of small shells, and collected into jars, the contents of which are afterwards made into balls of about half a pound weight, these are often coated with the seeds of some species of *Rheum* or rhubarb plant. The balls are packed into chests, and exported to other countries."

Opium is produced in large quantities in India for consumption in China, on account of the great sale there, in spite of all prohibitions. Eastern nations generally are very fond of opium, which they smoke with their tobacco, or alone, and take in the form of pills. With us, it is much used in medicine as an anodyne, especially in the well-known preparation called laudanum.

In 1852 fifty-one tons of opium were imported into the United Kingdom, principally from the East Indies and Turkey. Turkey opium is considered to be the best, especially that which comes from Smyrna.

Tobacco (*Nicotiana Tabacum*, L.; natural order, *Solanaceæ*).—The tobacco plant is an annual, growing six feet high, having alternate, oblong, lanceolate, sessile leaves, and dingy red, funnel-shaped flowers. The leaves are viscid and pubescent, and are the parts used in the manufacture of the tobacco.

The tobacco plant is indigenous to the warm parts of America, and was unknown in the Old World before the discovery of that continent. It was first brought to the notice of the Spaniards in 1492, when Columbus and his companions saw the natives of Cuba smoking cigars. It was introduced into England in 1586 by Sir Francis Drake, from

Hosted by Google

Virginia, where an English colony had remained for a year. The colonists are said to have brought tobacco with them on their return, and to have introduced into this country the practice of tobacco-smoking, or as it was at first called, tobacco-*drinking* or *sucking*. Sir Walter Raleigh and other young men of fashion gave it every encouragement, by smoking themselves, and the habit was soon acquired by the English, as it had previously been by the Spaniards, the first method of imbibing the fumes being by means of a walnut-shell and a straw. The tobacco plant appears to thrive in all parts of the world in warm climates, and is now cultivated almost everywhere. The practice of smoking has become almost universal, both amongst savage and civilised nations; for no habit is more easily acquired or more difficult to relinquish than the use of this weed, hence its rapid progress amongst nations, despite of all the efforts of their rulers at prohibition. The priests and sultans of Turkey and Persia declared smoking to be a sin against their holy religion; yet the Turks and Persians became the greatest smokers in the world. Pope Urban VIII. fulminated a bull against the use of tobacco, but the anathema fell to the ground. In Russia the smoker was threatened with the knout for the first offence, and with death for the second; yet the Russians are now constantly with pipes in their mouths. In our own country James I. wrote a book against it, called "A Counterblaste to Tobacco;" but instead of checking, it rather tended to promote the spread of the habit among his subjects.

Tobacco is manufactured in various forms to fit it for smoking, chewing, or snuffing, and the annual consumption in these different forms is so enormous that no estimate can be made of the quantity. In 1867 the imports into the United Kingdom amounted to 57,586,287 pounds of unmanufactured tobacco, and 3,798,999 pounds of manufactured tobacco, cigars, and snuffs; and some other nations are more addicted to the use of tobacco than ourselves.

Hosted by Google

After the plants have done blooming they are cut down and hung up to dry on poles; the leaves are then stripped from the stems, sorted, packed in boxes or casks, and shipped. On arriving in this country the leaves are taken out of the casks, and when their midribs have been removed, are spread on the floor and moistened with water. This is all that English manufacturers are allowed to do; on the Continent salt and sugar are added. The leaves are then compressed into dense cakes, and cut with a machine; and the cut tobacco, shaken out and afterwards steamed, is called, according to the leaf used, *Virginia shag*, *Maryland returns*, &c. In *Bird's-eye* tobacco the midrib is allowed to remain in the leaf, and forms those little white bits which have given it its fanciful name. The dried leaves, moistened with sugar and water, and pressed into cakes, form *Cavendish* and *Negrohead*, used for chewing and smoking. The same leaves moistened with sugar and water, beaten until soft, and then twisted into a sort of string, constitute pig-tail. The leaves and stalks ground to powder and roasted form snuff, which is variously scented to suit the different olfactory tastes of customers. Cigars are only the dried leaves deprived of their midribs and wound into a sort of spindle form; cheroots are a variety of cigar, cut straight at each end, cylindrical, and tapering, broader at one end than the other; cigarettes are made by rolling up a small quantity of cut tobacco in a piece of paper (the leafy covering of the Indian corn is preferred), they are then smoked the same as cigars, but usually by moderate smokers.

There are numerous varieties of tobacco found in commerce. The principal sorts are :—

North American tobacco, chiefly from the states of Virginia, Maryland, and Kentucky; but now, Tennessee, North Carolina, Louisiana, and Missouri also produce tobacco. Usually imported in hogsheads in the leaf, hence called leaf-tobacco.

South American tobacco, which is received in the form

Hosted by Google

of cylindrical rolls two feet in length and one foot in diameter, made by rolling or twisting the tobacco leaves into a kind of rope about an inch or more in diameter, and then coiled up into these cylindrical rolls as the most compact and convenient form for transportation. We receive supplies from the Orinoco, Porto Rico, and from Maracaibo, and other South American ports. Roll tobacco is sent over in baskets made of twisted cane, called *canastras*. A considerable quantity of South American tobacco comes from the Brazils, both in the leaf and roll form.

The tobacco of Cuba is considered to be the finest in the world: Havana tobacco makes the best cigars.

Asiatic tobacco. — Asia produces good tobacco, but mostly for her own consumption. The European market, however, gets the Persian or Shiraz, which is much esteemed. Tobacco is also received from the Spanish island of Manilla in the shape of fine cigars, which are manufactured there, and then exported. A little tobacco is sent from India, Ceylon, Java, and Sumatra. From Turkey, Latakia tobacco is imported, which consists of not only the leaf, but also the flowers and buds of the plant; it is so called after the Turkish province of Latakia (the ancient *Antioch*), where it is grown. Some considerable trade is carried on in the south of Europe with this tobacco, which is excellent and mild.

NUX VOMICA (*Strychnos nux vomica*, L.; natural order, *Loganiaceæ*).—A medium-sized tree, with opposite, ovate, stalked, three to five-nerved, smooth, shining leaves, and greenish-white flowers; a native of the East Indies, very common on the coast of Coromandel. The fruit is a globular berry, about the size of an orange, and with a smooth, hard, yellow rind, containing five seeds embedded in the pulp. These seeds are circular, flattened, rather less than an inch in diameter, slightly concave, silky in appearance, and fawn-coloured, or light drab in colour.

Strychnine, the most energetic poison known, is procured from the bruised seeds of the *nux vomica*, which are

Hosted by Google

imported from Coromandel and Ceylon. It is sometimes employed in cases of paralysis, and is much used as a poison for rats and mice. The annual imports now average about 250 tons.

IX.—Miscellaneous Medicinal Products.

Aloes (*Aloe Socotrina*, Tournef.; natural order, *Liliaceæ*). —This drug is the bitter, resinous, inspissated or thickened juice which is obtained from the leaves of various species of arborescent aloes growing in tropical climates. The species belong to the lily family, and have very large succulent leaves. The leaves are cut off close to the stem, and so placed that the juice is drained from them into tubs; this juice is then boiled until it acquires the consistence of honey, and poured into gourds or calabashes, when it hardens into a black compact substance, having an aromatic smell and an exceedingly bitter taste.

There are four principal varieties of aloes in commerce: 1. *Socotrine Aloes*, the best, produced by the above-named species, and so called from the island of Socotra, on the south coast of Arabia, in the Indian Ocean. 2. *Barbadoes Aloes*—of a very fine quality, produced by *Aloe vulgaris*, which is indigenous to the English island of Barbadoes, and also to Jamaica, Arabia, and the east coast of Africa. The Barbadoes aloes is imported from Barbadoes or Jamaica, usually in gourds weighing from sixty to seventy pounds, but sometimes in boxes holding about half a hundredweight. 3. *Cape Aloes*—very inferior, which is the product of *Aloe spicata;* raised in large quantities at the Cape of Good Hope, and brought over in chests and skins, the latter being preferred. 4. *Caballine*, or *Horse Aloes*. This is the poorest kind; it is generally the refuse of the Barbadoes aloes, and, from its very rank and fetid smell, can only be used in veterinary medicine.

In 1863 we imported 312 tons of aloes, valued at about £25,685.

Hosted by Google

LIQUORICE (*Glycyrrhiza glabra*, L.; natural order, *Leguminosæ*).—This is a perennial plant, having long yellow fibrous roots running deeply into the ground, with an herbaceous stem four to five feet in height, and alternate pinnate leaves; flowers blue, papilionaceous, disposed in axillary spikes. Liquorice is a native of Italy, Spain, Sicily, and the southern parts of Europe; but it has been successfully cultivated in England, even from the reign of Queen Elizabeth, especially at Pontefract in Yorkshire, and Mitcham in Surrey. The greatest portion of our supplies of that extract of the root which forms the common liquorice of the shops, is obtained from the Spanish provinces of Arragon, Catalonia, and Valencia. The juice, procured from the root by compression in a mill, is boiled slowly until it becomes of the proper consistence, and is then made into sticks or bars from six to eight inches long, which are usually covered with bay leaves, and imported under the name of Spanish juice. Liquorice in the form of paste, or of the root itself, is in common use as an emollient in catarrh or cough; the root is also much used by brewers in the manufacture of porter. About 560 tons of the root and paste are annually imported.

IPECACUANHA (*Cephalis ipecacuanha*, Rich.; natural order, *Cinchonaceæ*).—This is a perennial plant growing in Brazil, about five or six inches high. The roots are several inches long, contorted, greyish brown, annulated, and about the thickness of a goose quill. The root of this plant affords a very important emetic medicine. It is imported from Rio Janeiro in bales, barrels, and bags.

RHUBARB (*Rheum palmatum;* natural order, *Polygonaceæ*).—The well-known purgative is the root of different species of *Rheum* growing in Tartary and other parts of Asia. There are two sorts, viz., Russian or Turkey rhubarb, which is brought by the Chinese to Kjachta, and there cleaned and sent on to Moscow and St. Petersburg; and the East Indian or Chinese rhubarb, which is shipped from Canton to Europe. There are several other varieties in the market,

Hosted by Google

but the above are the most generally employed in this country. We import annually about 140 tons.

JALAP (*Exogonium purga;* natural order, *Convolvulaceæ*).—This valuable purgative medicine derives its name from Xalapa in Mexico, where it is very abundant. It is a handsome climbing convolvulaceous plant with delicate pink flowers and a tuberose root. The tubers, varying in size from a walnut to an orange, are dark umber-brown in colour, and much wrinkled. They are imported either whole or sliced; and we receive from Mexico about 150 tons per annum.

CHAMOMILE (*Anthemis nobilis*, L.; natural order, *Compositæ*).—This is a well-known perennial plant, not unfrequent on dry, gravelly, or sandy heaths, and in the pastures of this country. The whole plant is intensely bitter, and an infusion of its flowers has long been esteemed as a tonic and stomachic, and used as an ingredient in fomentations. This plant is cultivated in England, and the flowers sold by druggists are the produce of the cultivated variety. Chamomile flowers are also largely imported from France, Holland, and Germany.

SARSAPARILLA (*Smilax officinalis;* natural order, *Smilaceæ*).—The rhizome of this plant is cylindrical, and the roots (the sarsaparilla of commerce), abounding more or less in starch, are as much as ten feet long. It grows on the slopes of the mountains, and is confined to South America, where it ranges from 20° N. to 6° S. latitude. Jamaica, whence so much sarsaparilla is exported, does not produce any; the article known as Jamaica sarsaparilla is merely exported from the Spanish main for re-shipment. Sarsaparilla is imported in bales, and is known in the market as Lisbon or Brazilian, Honduras, and Jamaica or red sarsaparilla, of which the last is the most preferred. The imports in 1853 were 334,857 lbs.

Sarsaparilla is now regarded as a powerful alterative medicine in cases of physical debility. Its usefulness is

Hosted by Google

daily manifested in the public hospitals, in cases of broken-down constitutions, so common to the class of patients by whom those establishments are frequented. It is chiefly used in rheumatic and cutaneous diseases. A concentrated liquid extract and a syrup are now prepared, which are the best forms under which it can be taken.

SENNA (*Cassia lanceolata;* natural order, *Leguminosæ*).—The senna of the shops consists of the leaflets of different species of *Cassia*, such as the one above, and also *C. obovata*, *C. acutifolia*, *C. elongata*, and *C. Æthiopica*—all small shrubs with simple abruptly pinnate leaves, and yellow flowers, growing in tropical Asia and Africa. True senna leaves may be recognised by their oblique lower edges, and the inequality of their insertion into the foot-stalk; their odour is very faint, but peculiar; and their taste is sweetish and nauseous. The following varieties are met with in commerce:—

1. *Alexandrian Senna*, or the leaves of *Cassia lanceolata* and *C. obovata*. These plants grow in Upper Egypt and Arabia. The harvest commences in September. The branches of the shrub are cut, collected into bundles, dried in the sun, and then threshed until the leaves are separated from them. This process breaks the branches, and the leaves thus become mixed with portions of twigs. The senna leaves so obtained are then put into sacks and conveyed to the Nile, and carried down the river to Cairo and Alexandria. There they are unpacked, sorted, and repacked in large bales, and are then ready for the market.

2. *East Indian* or *Tinnivelly Senna*, the product of *Cassia elongata*, indigenous to Arabia and Africa, now cultivated in India, consists of long, thin, unbroken leaves of a yellowish-green colour. When good, it is fully equal to the Alexandrian.

3. *Tripoli Senna*, the product of *Cassia Æthiopica;* not held in much estimation.

Hosted by Google

X. Miscellaneous Plants of Commercial Value.

Vegetable Ivory—Corozo Nuts (*Phytelephas macrocarpa;* natural order, *Phytelephanteæ*).—The *Phytelephas*, twenty feet in height, resembles a dwarf palm, with a majestic tuft of pinnate leaves; it is a native of the low valleys of South America between 9° N. and 8° S. latitude, and between 70° and 79° W. longitude. Its nuts are enclosed in a large capsule about the size of a man's head, and, owing to the shortness of the stem, often rest on the ground. The albumen of the nut is "at first a clear insipid fluid, with which travellers allay their thirst; afterwards this same liquor becomes milky and sweet," consolidating by degrees till it becomes as white and hard as ivory. The nuts themselves, under the name of Corozo nuts, are imported in large quantities, being used by turners in making a vast variety of trinkets and articles to imitate ivory. About 80,000 of these nuts were imported in 1852.

Coquilla Nut (*Attalea funifera;* natural order, *Palmaceæ*).—This is the fruit of a South and Central American palm. It is a nut of not more than three inches in length and two in breadth, and is completely solid, excepting a small cavity in the centre, in which the seed is deposited. The shell is, therefore, very thick, and it is also very hard, taking a fine black polish. Coquilla nuts are used chiefly by ornamental turners for the production of small knob handles for cabinet drawers, parasol and umbrella handles, chessmen, rings, brooches, and small toys. About 300,000 nuts were imported in 1852.

Marking Nut (*Semecarpus anacardium;* natural order, *Anacardiaceæ*).—A native of the East Indies. This nut, somewhat like a tamarind stone, has an exterior covering formed of two laminæ, between which is a caustic bitter juice staining an indelible black, and which is much used as a black varnish, as well as for marking linen, whence its

Hosted by Google

name, Marking Nut. It is imported into this country for these purposes.

TONQUIN BEAN (*Dipterix odorata;* natural order, *Leguminosæ*).—The seeds of the Tongo tree, a native of Guiana, are the well-known Tonquin beans used to scent snuff.

ORRIS ROOT (*Iris Florentina;* natural order, *Iridaceæ*).—This plant is a native of Italy, and cultivated in gardens. Orris root is used as an ingredient in tooth powders, and in the perfumed preparation of wheat starch called violet powder. About five tons are annually imported.

CRABS' EYES (*Abrus precatorius;* natural order, *Leguminosæ*).—This is a pretty climbing plant, a native of the West Indies. Its seeds are bright scarlet, jet black round the hilum, and very handsome. Coral beans are used by druggists and jewellers as weights, being almost uniformly one grain. They are also strung together for necklaces and rosaries, as are the crabs' eyes.

CORK OAK (*Quercus suber*).—This tree closely resembles the *Quercus ilex*, L., or evergreen oak, so well known in English shrubberies. It is indigenous to the mountainous regions of Spain, Portugal, and the South of France. It grows from thirty to forty feet high, and from two to three feet in diameter. Spain and Portugal supply the greatest portion of the cork which is used in Europe; abundant supplies are also received from the South of France at the foot of the Pyrenees, the islands of Sardinia and Corsica, and the forests of Algeria.

When this tree is about five years of age, the cork, which composes the greater part of its bark, begins to increase in a very remarkable manner. Nearly all its vegetative activity seems to be concentrated on this part, which grows unusually large, thick, and spongy. If left on the tree it becomes cracked and so deeply fissured that it is unfit for use. It is therefore removed before this happens. Its removal does not injure, but is beneficial to the tree, for if the cork is allowed to remain on its stem, the cork-oak seldom lives

Hosted by Google

longer than fifty or sixty years; if, on the contrary, it is removed, the tree flourishes sometimes for upwards of 150 years. After the tree is thirty years old its cork may be removed at intervals of from six to ten years. The first crop of cork is generally inferior in quality, and is principally used for making floats for fishing nets. The crops are usually gathered in the months of July and August. Two opposite longitudinal incisions into the bark are made the whole length of the stem, and then several transverse ones about three feet apart. The bark is now beaten to separate it from the subjacent liber, and detached in cylindrical pieces by inserting under it the handle of the instrument, which is curved and made thin at its extremity for this purpose. In effecting this removal great care is taken not to injure the newly-formed suber or cork—viz., the living layer of cork beneath. After barking, the pieces of cork are slightly charred to close the pores, then loaded with weights to flatten them, and finally stacked in square masses in some dry place, where they remain for two or three months. In drying they lose about one-fifth of their weight.

Only when the trees are forty or fifty years old is the bark sufficiently matured for making good corks. This substance is valuable for bottle corks, because it is light, porous, compressible, and sufficiently elastic to adapt itself to the neck of a bottle. It can be cut into any shape, and, notwithstanding its porosity, is impervious to any common liquid. These qualities make it superior to all other substances as a stoppering for bottles, for which it is principally used. Corks are made as follows:—

The cork is first cut into slips, which by means of a gauge are made narrow or wide, according to the size of the corks or bungs ordered; these slips are then cut into squares of the required length, which are cut circularly with a knife by the hand, and thrown into a basket. Cork-cutting in Catalonia and the South of France is a branch of manual labour which furnishes a livelihood for a considerable por-

Hosted by Google

tion of the population. Several attempts have been made to cut corks by machinery, but they have hitherto failed to supersede hand labour.

Cork is largely manufactured into soles for boots and shoes. Cork legs, hat frames, mattresses, bolsters, life-preservers, and lifeboats are also manufactured from cork. Coffins were made of it by the ancient Egyptians. Many of the wealthier inhabitants of Spain have their houses lined with cork, which ensures the freedom of the rooms from damp. Cork, in thin slips, is used by entomologists as a lining to drawers and cabinets in which to fasten their insect pins. Spanish black and a black colour for painters are made from the calcined parings of cork.

The quantity of cork annually imported into the United Kingdom is about 3,000 tons. The price per ton varies from £17 to £50, according to quality. The Spanish cork is the best, and fetches the highest price. Unmanufactured cork is admitted into England duty free. The duty on corks ready made is eight shillings per pound; corks only squared and rounded pay sixteen shillings per cwt.; and fishermen's corks two shillings per cwt.

BALSA (*Ochroma Lagopus;* natural order, *Sterculiaceæ*). —The wood of this tree, being soft and light like cork, is used for stopping bottles. The never-sinking rafts, which at the discovery of South America caused such surprise, were constructed of it, and are so still. This tree prevails along the coasts of South America and the West Indies. The silky hair of the capsule of this plant, as well as that of other species of the order, is employed for stuffing pillows and cushions.

SODA and POTASH, which occur abundantly in plants, are important articles in commerce, and the plants which yield them are therefore deserving of notice. A large proportion of the plants growing on sea-coasts contain soda, whilst inland plants contain potash. Various species of *Salsola*, especially *S. kali*, *S. Salicornia*, and *S. Kochia*, furnish

Hosted by Google

the soda of commerce. The best soda comes to us under the name of barilla, which is, in fact, the incinerated ash of *Salsola kali*. This plant is carefully cultivated in the Spanish provinces of Murcia, Valentia, Carthagena, Malaga, and Alicant, which carry on a considerable trade in the article.

"The seed is sown in light soils, which are embanked towards the sea-shore, and furnished with sluices for admitting an occasional overflow of salt water. When the plants are ripe, the crop is cut down and dried, the seeds are rubbed out and preserved, and the rest of the plant is burnt in rude furnaces, at a temperature just sufficient to cause the ashes to enter into a state of semi-fusion, so as to concrete on cooling into cellular compact masses. The most valuable variety of this article is called *sweet barilla*. It has a greyish-blue colour, and becomes covered with a saline efflorescence when exposed for some time to the air. It is hard and difficult to break; when applied to the tongue it excites a pungent alkaline taste." * An inferior soda is made in France, England, Ireland, and the Shetlands, from sea-weed, and brought into commerce under the name of kelp. Large revenues are derived by the proprietors of the shores of the Scottish islands from the incineration of sea-weed by their tenants, who usually pay their rent in kelp. Carbonate of soda is now made from common salt (chloride of sodium), yet the burning of seaweeds, &c., is still largely followed for the sake of the iodine contained in the ashes.

Potash is prepared for commerce by evaporating in iron pots the lixivium of wood-ashes; hence the name potash. The potash in plants is very soluble in water. If the wood-ash, which is an impure carbonate of potash, be put into water, and quick-lime be added to the solution, the lime will abstract the carbonic acid from the carbonate of potash, and form an insoluble carbonate of lime, which will be precipitated, and the potash will be taken up by the water, which

* "Ure's Dictionary of Arts, Manufactures, and Mines," vol. iii., p. 705. 1867.

Hosted by Google

will thus be rendered powerfully alkalinic. The lixivium or clear alkaline liquor thus obtained is then decanted off, and evaporated to dryness in iron pots, the residuum is calcined to remove all organic matter, and the product thus obtained forms the crude potash of commerce. The different varieties of potash are named either after the locality in which they are produced, or the route by which they arrive. Thus we have American, Russian, German, Illyrian, Saxon, Bohemian, and Heidelberg potashes. When still further purified, by additional calcination, potash is termed pearl-ash.

Potash can only be obtained abundantly in countries where there are vast natural forests, and where wood is so cheap that it only costs the labour of felling and hauling. In many parts of America, where timber is an encumbrance on the soil, it is felled, piled up in pyramids, and burned, solely with a view to the manufacture of this product.

Potash is a very considerable article of commerce. Russia produces annually over 300,000 cwts., which are exported from Petersburg, Riga, and Archangel; and from Poland, *viâ* Warsaw and Cracow: from East and West Prussia, *viâ* Dantzic and Konigsberg, vast quantities of potash are also exported. Hungary produces annually 150,000 cwts. of potash, of which 50,000 cwts. go to supply the demand in Bavaria and Saxony. The Harz district, the forests of Thuringia, and almost all parts of Germany rich in wood, supply potash. In modern times, however, it is received in the greatest quantities from Canada and the United States, *viâ* Boston and New York.

Potash is largely consumed in the manufacture of glass, porcelain, earthenware, and gunpowder; in colour and chemical manufactories; and also in dyeing and bleaching.

TINDER.—The internal spongy portion of several species of *Polyporus*, soaked in a solution of nitre, forms tinder. The principal places for the production of this fuel are, besides Hungary, Poland, Sweden, and the Alsace, the country around Ulm, Nuremberg, Augsburg, and Frankfurt in

Hosted by Google

Germany. Germany supplies the French, English, and Dutch markets, and Sweden the countries around the Baltic.

FULLER'S TEAZEL (*Dipsacus Fullonum;* natural order, *Dipsacaceæ*).—This plant is closely allied to the Compositæ, but differs in having free stamens, and a pendulous ovule. It is valuable for its large conical composite flower-heads, which have hard stiff bracts, the sharp points of which are hooked. These bracts remain after the flowers have died, and their points are so admirably adapted for raising the nap on woollen cloth, that no invention has yet been found to supersede them. Many carding machines have been introduced, but the best clothiers still prefer the teazel for finishing their cloth. For this purpose, the conical teazel heads are cut up into halves and quarters, and fixed into a cylindrical frame, with the hooked bracts outwards, which frame is made to rotate over the surface of the cloth, until the little sharp hooks of the teazel have scratched up the required nap. Teazel heads, under the name of weavers' carders, are an extensive article of commerce, and cultivated in France, Italy, Holland, Germany, and the West of England. Large quantities are annually imported into the United Kingdom from Hamburg and Holland. The teazels are made up into bundles for sale to the clothiers, each bundle containing from 9,000 to 10,000 plants. In addition to our home produce, 14,022,384 teazel heads were imported in 1853.

RATTANS (species of *Calamus;* natural order, *Palmaceæ*).—These palms yield the canes or rattans of commerce. They have very long slender stems, with leaves at considerable distances apart, and the climbing species reach the tops of the highest trees by means of the powerful whip-like prolongations from the midribs of the leaves. The stems contain a considerable amount of silex, which renders them hard and gives them a glossy appearance. *C. rudentum* produces stems 300 feet in length, which make excellent ropes of immense strength, and as such are used by the

Hosted by Google

native Hindoos in catching elephants. *C. Scipionum* furnishes the walking-sticks known as Malacca canes. *C. rotang*, *C. rudentum*, *C. verus*, *C. viminalis*, and others are used in this country for the bottoms of chairs and couches, the sides of carriages, &c.; and in India are made into baskets, mats, hats, and other useful articles. They are also used as ropes and cables, in the junks and coasting vessels, and take the place of chains in native suspension bridges.

The rattans are found in commerce in bundles, each cane being once or twice doubled up in order to make the bundle smaller and more compact; the canes are very seldom less than twelve or even sixteen feet in length. About 75,000 bundles of canes, 100 canes being in each bundle, or 7,500,000 canes, are annually imported into the United Kingdom. Holland also imports annually several million pieces. Bengal, Arracan, and the Sunda islands produce the greatest quantity of rattans, and Europe is supplied with them *viâ* London, Amsterdam, and Rotterdam.

BAMBOO (*Bambusa arundinaceæ;* natural order, *Graminaceæ*).—This gigantic tropical grass is extensively spread over India, China, and Japan. It grows like a tree, shooting up with great rapidity in two or three months to a height of fifty or sixty feet. Its hollow stems, which attain a diameter of seven or eight inches, are much used for building purposes in the countries where it grows, and its young shoots serve as walking-canes. The Chinese make from the inner bast-like bark an inferior kind of paper.

BULRUSHES (*Scirpus lacustris*, L.; natural order, *Cyperaceæ*).—The bulrush, or bull-rush, grows along the margins of rivers, lakes, and ponds, especially in Northern Europe and the Netherlands. This plant is used in making the seats of rush-bottomed chairs; it is also in great demand among coopers, who place it between the staves of casks intended to hold liquid. The pithy structure of the rush induces the swelling of the culm, and the interstices

Hosted by Google

between the staves are thus closed, and the cask rendered water-tight. Many vessels laden with this rush arrive annually in England from Holland and Belgium, bringing thirty or forty tons of rushes each voyage. This is a very large quantity considering the lightness of the material. More than 1,000 tons of bulrushes are annually imported into the United Kingdom.

SOFT RUSH (*Juncus effusus*, L.; natural order, *Juncaceæ*).—The pith of the common soft rush, as also that of *Juncus conglomeratus*, is employed for making the wicks of rush-lights, which continue to be used, although not so much as formerly.

In Japan, the manufacture of mats, &c., from rushes, is a regular trade. The floors of their houses are covered with rush mats of great beauty and variety, and rush mats are the only carpets and beds used by the Chinese. A light sort of matting made of the same material is used as a window blind. The sugar sent home from the East Indies is packed in bags made of rush-matting. The size of the Japanese rush mats appears to be regulated by law, for they are all of the same magnitude throughout the kingdom, the only exception being the mats in the imperial palace at Jeddo. Rushes are also used for chair bottoms and baskets.

DUTCH RUSH (*Equisetum hyemale*, L.; natural order, *Equisetaceæ*).—Used for polishing hard woods, alabaster, marbles, and other substances, for which purpose it is well adapted, by the large quantity of silex which is contained in its cuticle. The invention of sand- and emery-papers in modern times has, however, now almost superseded this natural polisher. It is still much used in Holland, where it grows abundantly in low boggy ground; it is found in damp woods in this country, but is occasionally imported from Holland.

BAST (*Tilia Europœa*; natural order, *Tiliaceæ*).—The common linden or lime-tree is easily recognised by its obliquely cordate, unsymmetrical leaf, and the curious bract to

Hosted by Google

which the peduncle or flower-stem adheres. In Northern Europe and Russia, bast mats, ropes, and twines are made from the inner fibrous bark of this tree. At the proper season the stems are cut longitudinally, and the bark is taken off in long strips. The outer bark is easily separated from the inner; and the latter dried constitutes the bast of commerce. This is plaited by the Russians into mats from a yard and a half to two yards square, which are much used by gardeners and upholsterers. These mats are also employed for lining the holds of vessels intended to receive corn. Not fewer than 14,000,000 are annually imported into the United Kingdom from various Russian ports, but chiefly from Archangel.

Hosted by Google

Hosted by Google

PART III.

THE COMMERCIAL PRODUCTS OF THE ANIMAL KINGDOM.

INTRODUCTORY.

In the animal as in the plant world, we find progressive organic development, boundless diversity of structure, and a beautiful subserviency of means to ends. The highest type of life is man. The different grades of organisation have their purposes to fulfil, and each animated being has its own position independent of the rest yet subordinate with reference to others of more complicated form and frame, especially with reference to man, for whose benefit all seem to exist.

With the scientific classification and description of living creatures has lately arisen a desire for a scientific designation of their economic uses, and a statement of their comparative commercial value, in order that the appliances of social life and the claims of civilisation may advance with the progress of inquiry, and the diffusion of knowledge.

Energy and skill are alike taxed for the discovery of new properties in the animal, the vegetable, and the mineral kingdoms; or for the further utilisation of properties long known. A careful study, then, of the contents of a collection like that in the South Kensington Museum, together with the greater variety passing through our custom-house

Hosted by Google

from the cargoes of all nations, must be highly important, while it can hardly fail to be interesting.

There is but one path for the successful pursuit of knowledge so valuable and so honourable—the path of science; for science is the track of truth, plain in all simplicity, yet revealing the symmetry and the beauty of the works of the Creator.

Zoological Classification.

Naturalists have arranged the animal kingdom into two grand divisions.

I. Vertebrata (Latin, *verto*, I turn), or vertebrated animals, having the central portion of the nervous system, or the brain and spinal cord enclosed, the former in a cavity called the cranium or skull, and the latter in a canal composed of a succession of united vertebræ, or bony segments, or, as in some fishes, of cartilage.

The vertebrated animals are arranged in five classes:—

1. *Mammalia* (Latin, *mamma*, a teat). Animals which possess mammary glands and suckle their young, bringing them forth alive. Examples: the monkey, ox, seal, elephant, and whale.

2. *Aves* (Latin, *avis*, a bird). Oviparous vertebrated animals covered with feathers and organised for flight. Examples: the ostrich, swan, pheasant, and eagle.

3. *Reptilia* (Latin, *repo*, to creep). Cold-blooded vertebrated animals, covered with scales or hard bony plates, terrestrial or aquatic, air-breathing, and endowed with extraordinary powers of endurance under abstinence, or against bodily injury. Examples: the turtle, snake, crocodile, lizard.

4. *Amphibia* (Greek, *amphibios*). Fish-like in the early period of their existence, breathing exclusively by gills and having a two-chambered heart, finally becoming air-breathers, acquiring lungs and a three-chambered heart, losing wholly or partially their piscine character, and becoming more or less terrestrial. Examples: the frog, toad, and proteus.

5. *Pisces* (Latin, *piscis*, a fish). Oviparous vertebrated

Hosted by Google

animals having a branchial respiration, a covering of scales, and an organisation for life in the water. Examples: the sturgeon, cod, and herring.

II. INVERTEBRATA, or animals destitute of a cranium or skull, and a vertebral column.

The invertebrated animals comprise four sub-kingdoms:—

1. *Mollusca* (Latin, *mollis*, soft), or soft-bodied animals, popularly known as shell-fish. Examples: the oyster, pearl-oyster, and mussel.

2. *Annulosa* (Latin, *annulus*, a ring), or ringed animals. Examples: crabs, leeches, and insects.

3. *Cœlenterata* (Greek, *cœlos*, hollow, and *enteron*, an intestine), or hollow-intestined animals. Examples: the sea-anemone, and red coral.

4. *Protozoa* (Greek, *protos*, first, and *zoon*, animal), or first animals. Example: the common sponge.

We now purpose taking up the various animal products according to the above zoological arrangement. We begin with the highest and most useful class of vertebrata, or the

PRODUCTS OF THE CLASS MAMMALIA.

This class comprises twelve orders, viz:—

1. *Bimana* (Latin, *bis*, twice, and *manus*, the hand), or two-handed animals. Example: man.

2. *Quadrumana* (Latin, *quatuor*, four, and *manus*, the hand), or four-handed animals. Example: the monkey.

3. *Cheiroptera* (Greek, *cheir*, the hand, and *pteron*, a wing), or hand-winged animals. Example: the bat.

4. *Insectivora* (Latin, *insecta*, insects, and *voro*, I devour), insect-eaters. Examples: the hedgehog, mole, and shrew.

5. *Carnivora* (Latin, *caro*, *carnis*, flesh, and *voro*, I devour), Flesh-eaters. Examples: the lion, tiger, fox, and ermine.

6. *Cetacea* (Greek, *ketos*, a whale), or whale-like animals. Examples: the whale and porpoise.

Hosted by Google

7. *Pachydermata* (Greek, *pachus*, thick, and *derma*, skin), or thick-skinned animals. Examples: the elephant, horse, and pig.

8. *Ruminantia* (Latin, *ruminare*, to ruminate), ruminating animals. Examples: the stag, ox, and sheep.

9. *Edentata* (Latin, *edentatus*, without teeth), toothless animals. Examples: the sloth and armadillo.

10. *Rodentia*, (Latin, *rodere*, to gnaw), gnawing animals. Examples: the squirrel, rat, rabbit, and hare.

11. *Marsupialia* (Latin, *marsupium*, a pouch), or pouched animals. Examples: the kangaroo, opossum.

12. *Monotremata* (signifying with one orifice or outlet), beaked, non-placental mammals. Examples: the porcupine-ant-eater and duck-mole of Australia.

The mammalia, living or dead, supply us with food in the forms of flesh and milk; also with fur, wool, skins, hides, horns, hair, hoofs, fats, oils, bone, ivory, &c. In some instances every part is available—as, for example, in the horse. Leather is made from the skin; the hair is manufactured into hair-cloth and bags for crushing seed in oil-mills; the flesh furnishes food for dogs, poultry, and even men; the intestines, a covering for sausages; glue and gelatine are formed from the tendons; knife-handles and phosphorus from the bones; and buttons and snuff-boxes from the hoofs.

I.—FURS.

We derive furs from all the orders of the mammalia, with but three marked exceptions. Man and the whales are well known to be smooth-skinned animals. It is, however, the Carnivora and Rodentia principally which supply the market with furs. All our furs, both home and foreign, are either felted or dressed; the former are used in the manufacture of hats, the latter as articles of clothing. Fur is one of the most perfect non-conductors of heat, and therefore, if properly prepared, makes the most comfortable clothing that can be worn in cold climates. We find the

Hosted by Google

animals there provided by Nature with this substance for their own protection, and therefore man has adopted it as the most suitable clothing for himself. In the prepared state skins are called furs; without preparation, *peltry*.

The hunter, as soon as the animal is captured and killed, strips off the skin, and hangs it up to dry, either in the open air or in a warm room. If the skin is well dried and properly packed, it may be sent to any distance, and will be received in good condition; but if any moisture is left in the skin, or if it becomes exposed to damp on the voyage, putrefaction ensues, the hair falls off, and it is unfit for use so far as the furrier is concerned. A minute examination of the skins received is therefore the first thing to be done; the grease is removed by steeping them in a liquid containing bran, alum, and salt, and by washing and scouring them; and the oil is extracted from the fur with soap and soda. By subsequent treatment, each skin is tanned and converted into thin leather. It is now washed in clean water and dried, and is then ready to be made up into articles of dress.

Felting is a process by which the different kinds of hair and wool are interlaced or intertwined, so as to form a close compact texture or mat. The felting capabilities of fur depend on the peculiar structure of the hair. Hair capable of felting has its surface covered with little serratures, which may be seen with the microscope; and the felting consists in simply entangling these serratures with each other, and so matting the hairs together. Hair which is devoid of this serrated structure will not felt.

The felting furs are confined to a few animals, such as the hare, rabbit, beaver, &c. These animals have two kinds of hair: a long and coarse kind, forming their visible external covering, which does *not* felt; and a shorter, finer, and more abundant kind, which lies close to the skin, and is called the fur, and which does felt easily. When the skins are intended to be felted, these long hairs are first

Hosted by Google

removed, either by being plucked out or by very careful shearing. In the case of the beaver and rabbit, the long hair is pulled out with a short knife, the thumb of the operator being protected by a leather shield. The long hairs thus removed are of no use to the hatter, but are sold for stuffing chairs. The fur is then cut from the skin in a light fleecy mass, and the flocks are tossed about by the strokes of a vibrating string or bow, until matted together into a thin sheet of soft spongy felt; a second sheet is pressed upon it, and then a third, until the required degree of strength and thickness of felt is obtained. The following are the most important of the fur-bearing animals:—

Quadrumana.

The chief monkey-furs imported are those obtained from the *howlers*, the largest of the New World monkeys. They are made up into muffs.

Carnivora.

These animals, next to the monkeys, are the most closely allied to man in organisation. Naturalists have divided them according to their mode of progression, which depends on certain peculiarities in the structure of their feet, into three leading groups:—

1. The *Digitigradæ*, or finger-walkers (Latin, *digitus*, a finger, and *gradior*, I walk), from their habit of walking on their toes. Examples: the lion, tiger, and cat.

2. *Plantigradæ*, or sole-walkers (Latin, *planta*, the sole of the foot), because applying the whole or the greater part of the sole to the ground when walking. Examples: the bear, raccoon, wolverine, and badger.

3. *Pinnigradæ*, or fin-walkers (Latin, *pinna*, a fin or feather), having their feet well adapted for progression through the water, by an expansion of the skin or web between the digits, and also for some slight degree of progression on land. Examples: the seal and walrus.

Hosted by Google

1. *Digitigradæ.*

This division of the Carnivora includes the Family FELIDÆ (Latin, *felis*, a cat), so named by Linnæus, because an excellent example is furnished in the common domestic cat. These are characterised by the strong, sharp, retractile talons with which all their toes are armed; they have teeth to correspond, peculiarly adapted for destroying other animals, and for tearing, dividing, and crushing flesh. Their sight is keen, to enable them to discern their prey, and they have great power of dissembling, so as to be able to lure their victims to destruction. It is most fortunate for mankind that these formidable animals have not the instinct of sociality; otherwise what could withstand a troop of lions or tigers hunting in concert like wolves? The most celebrated species of this genus is—

THE LION (*Felis leo*).—This magnificent animal is distributed over the African continent, and the southern parts of Asia. The long flowing mane of the male gives him a majestic appearance. His courage and strength are both indisputable, but he is as genuine a cat as the tiger, and quite as bloodthirsty and cruel in his disposition. About one hundred lion skins are annually imported into this country, chiefly from Africa.

THE TIGER (*Felis tigris*), inhabits the Asiatic continent, and is especially abundant in Hindostan. Nocturnal in his habits, lying during the day in some shady spot gorged with his last meal into sleepy indolence, the tiger frequents the neighbourhood of springs and the banks of rivers where the weaker animals, forced by the scorching heats of the tropics, seek coolness and drink. The skin is a bright tawny yellow, shaded into pure white beneath the body, and beautifully marked with dark bands and stripes. It is used to cover the seats of justice in China, and is also employed for rugs and mats. From 200 to 250 tiger skins are annually imported into the United Kingdom.

Hosted by Google

THE LEOPARD (*Felis leopardus*, Cuv.).—This animal is found in Africa and India; inhabits the deepest recesses of the forest, thus rendering pursuit nearly impossible. Taken usually in traps, it is also hunted with dogs until, being an expert climber, it takes refuge in a tree, and when the hunters come up, it is easily shot. The skin is a tawny yellow, the lower parts white, and covered all over with dark spots, which vary in size and form. It is worn as a mantle by the Hungarian nobles who form the royal body-guard of Austria; it is also used as a saddle-cloth in some of our cavalry regiments, as a mark of rank amongst the officers. About 200 leopard skins are sent annually to the English fur market.

THE JAGUAR, or AMERICAN PANTHER (*Felis onca*, L.).—A native of the warm parts of America, especially Paraguay and the Brazils. Next to the tiger, the strongest species of the genus; also an expert climber. The skin is beautifully marked with deep chocolate-brown spots upon a rich yellowish ground. From 300 to 400 skins of this animal are annually imported, and used as rugs, or for ornamental purposes.

THE PUMA, or AMERICAN LION (*Felis concolor*, L.).—Extensively distributed throughout the Southern American continent, found also in the warmer parts of North America. More frequently met with in grassy plains and marshy meadow-lands bordering rivers, than in the forest. This animal lives upon deer, hogs, and sheep, to which it is very destructive; for it is not satisfied with the simple seizure of prey, but, meeting with a herd of animals, will kill as many as possible, sucking only a portion of the blood from each. The fur of the puma is thick, close, and reddish-brown in colour, changing on the belly to a pale reddish-white. The skin, when imported, is used for carriage wrappers.

THE CANADIAN LYNX (*Felis Canadensis*, Geoffroy).—This is a timid creature, common in the wooded districts of Canada as far north as 66°, incapable of attacking the larger

Hosted by Google

quadrupeds, but well armed for the capture of the American hare, on which it principally feeds. It makes a poor fight when attacked by the hunter, spits and sets up its hair like an angry cat, but is easily destroyed by a blow on the back with a slender stick. From 15,000 to 20,000 lynx skins are annually sent over to this country by the Hudson's Bay Company.

THE COMMON CAT (*Felis domesticus*, L.).—In Holland the cat is bred for its fur, being fed on fish, and carefully tended until it arrives at perfection. We import annually 20,000 cat skins, and the English fur-market also receives a considerable quantity from home. The cat's skin makes an excellent rubber for electrical machinery, and is also used for sleigh coverings, railway rugs, &c.

The Family CANIDÆ (Latin, *canis* a dog) forms the next group of Digitigrade Carnivora, and includes dogs, wolves, and foxes. The different varieties of dog are supposed by some naturalists to have been derived from the wolf. The common dog (*Canis familiaris*, L.) is distinguished from the wolf and jackal by its recurved tail; but the species vary in size, form, and the colour and quality of hair, nearly *ad infinitum*. In most collections of fur, a few dog skins will be found, although there is no regular trade in them. The skin of

THE WOLF (*Canis lupus*, L.) is, however, valued. This animal, once indigenous to this country, but now exterminated, still lingers in the forests of Northern and Southern Europe, and is particularly abundant in Russia, North America, and the northern parts of Asia. From nine to ten thousand wolf skins are annually imported from Europe, the United States, and British North America. They are serviceable for the linings of coats and cloaks, for sleigh coverings, and wherever additional warmth is desirable.

THE RED FOX (*Vulpes fulvus*).—It is not the common European fox, but different varieties of the American (equally well known for its cunning and mischievous

Hosted by Google

attacks on the poultry yard) that is found in the furriers' shops of this country. The fox is easily distinguished by its long sharp nose and bushy tail. Foxes have been formed by zoologists into a distinct group amongst the Canidæ, or dogs, on the ground that the pupil of their eye is vertical, whilst in the dog it is circular. The tail of the fox is longer and more bushy, its head broader and more pointed in the muzzle, and its gait and attitude crouching. The red fox of America is ferruginous in colour, and strongly resembles the fox of Europe. About 8,000 skins are annually imported into England, most of them to be re-exported, chiefly into the markets of Turkey.

THE CROSS FOX (*Vulpes decussatus*).—This is probably only a variety of the red fox. It is distinguished by a black cross on the neck and shoulders, and is a South American animal. Its skin is valuable, selling for £4 or £5.

THE ARCTIC FOX (*Vulpes lagopus*).—This animal is very common within the Arctic circle, and exhibits in a remarkable manner that mutation of colour which polar animals undergo with the change of the seasons. In winter it is a pure white; in summer a dorsal line of a darker colour is observable, with transverse stripes upon the shoulders. This circumstance has led to its being mistaken for the Cross Fox. Late in autumn these animals collect in vast numbers on the shores of Hudson's Bay, and migrate southward, returning early in the following spring along the sea-coast to the northward. The southern limit of their migrations in North America is 50° north latitude. The Arctic fox is very cleanly in its habits, very unsuspicious, and easily snared. There is a dark variety known as the sooty or blue fox (*Vulpes fuliginosus*). Both the blue and the white skins are imported in considerable quantities, but they do not fetch so high a price in the English market as do the skins of the red fox.

THE BLACK or SILVER FOX (*Vulpes argentatus*).—This species is distinguished from the others by its intensely

Hosted by Google

black fur, which is intermingled with white silvery hairs, and has a white spot at the end of the tail. It is a native of the northern parts of the American continent. "An unusually fine skin of one of these animals has been sold in London for £100. The imperial pelisse of the Emperor of Russia, made of the black necks of the silver fox (exhibited at Hyde Park in 1851) was valued at £3,500."

THE COSSACK FOX (*Vulpes Cossac*). This fox inhabits the vast plains of Tartary. Its skin, which is of a clear ferruginous-yellow colour, is much prized in Russia and Turkey. Not fewer than from 40,000 to 50,000 of these animals are annually taken and sold.

The Family MUSTELIDÆ (Latin, *mustela*, a weasel) forms the last group of Digitigrade Carnivora whose skins supply our fur markets. This family includes the sable, polecat weasel, otter, and wolverine. These animals, from their peculiar appearance and habits, have been called vermiform quadrupeds. They are distinguished by the length and slenderness of their bodies, which enable them to wind like worms into very small openings and crevices, whither they easily follow the smaller mammalia and birds on which they prey. Several of them, as the polecat, emit a very offensive odour; nevertheless, they yield the most costly and highly-prized of our furs.

THE ERMINE (*Mustela erminea*).—This, the most interesting species of the weasel family, resembles the common English weasel, and inhabits Siberia, Russia, Norway, and Sweden. In winter it is clothed by Nature with a fur as white as the snow which then covers the ground, and is thus rendered invisible to its numerous enemies; in summer its garb changes to a dingy brown.

The white fur of the ermine is highly esteemed. It is the royal fur of England and of the sovereigns and emperors of Europe. The pope and his cardinals have their ecclesiastical robes adorned with capes and trimmings of ermine, according to their rank. The tail alone of the

Hosted by Google

ermine is jet black, and this is inserted at intervals into the prepared furs as an ornament.

"In England there is now no restriction on the wearing of this fur, but in the reign of Edward III. it was forbidden to all but the royal family, and a similar prohibition still exists in Austria. There is, however, a characteristic distinction made in the mode of ornamenting the fur employed on state occasions, according as it is worn by the sovereign, or by peers, peeresses, judges, &c. The sovereign and royal family can alone wear ermine trimmings in which the fur is spotted all over with black—a spot in about every square inch of the fur. These spots are not formed of the tail of the ermine, but of the paws of the black Astracan lamb. The crown is also adorned with a band of ermine with a single row of spots. Peeresses wear capes of ermine, in which the spots are arranged in rows, the number of rows denoting their degrees of rank. Peers wear robes of scarlet cloth, trimmed with pure white ermine without any spots. But the number of rows, or bars of pure ermine, in this case also denotes the rank. The robes of judges are also scarlet and pure white ermine."*

The number of ermine skins annually imported is upwards of 100,000, and of these very few are re-exported. The fur of the ermine is manufactured into ladies' muffs, tippets, trimmings, and linings.

THE RUSSIAN SABLE (*Mustela Zibellina*).—This is the next fur to ermine in value and in general use. The animal which yields it lives in the wilds of Siberia, and is hunted in the depths of winter, when its fur is most valuable. The fur is brown, with some grey spots on the head. The darkest in colour are considered to be the best. The skins are small, but they are sold at prices varying from three to ten guineas. Only about 2,000 of these valuable furs are received in England, because so much prized in Russia, where about 25,000 skins are annually collected.

* "Cyclopædia of Useful Arts." By Charles Tomlinson. Vol. I, p. 729.

Hosted by Google

This fur is usually manufactured into linings, sometimes valued as high as 1,000 guineas. The Lord Mayor, aldermen, and sheriffs of the city of London, have their robes and gowns lined with Russian sable, according to their respective ranks. The tails of sables are used in the manufacture of artists' pencils and brushes.

THE MINX (*Mustela vison*).—This animal is a native of North America, and its skin comes to us principally through the Hudson's Bay Company. In the month of March this Company holds annually, in London, a public fur sale, which attracts great numbers of foreigners. Through them, the furs destined for the Continent find their way to Leipsic, whence they are distributed throughout Europe. The fur of the minx resembles the sable in colour, but is considerably shorter and more glossy. It is much used for ladies' wear, and is made into victorines, cloaks, muffs, &c. In a single year, the number of skins of this little animal received in this country have amounted to a quarter of a million. Their price varies from ten to fifteen shillings a-piece. When this skin is of a silver-grey colour it is additionally valuable. A muff made of six of such skins is worth twenty-five guineas.

THE AMERICAN SABLE (*Mustela leucopus*).—The fur of this animal varies from a tawny colour to a deep black. The animal itself is known by its white feet. The fur is much worn in England, and is made into cuffs, muffs, and boas. In 1856, 206,000 marten skins were imported. Of these the greater number belonged to this species.

THE POLECAT (*Mustela putorius*).—Common throughout Europe. Very destructive in the poultry yard, and very courageous. Its flexibility is so great, that when seized improperly by a terrier, or not griped in the right place, it will turn and fasten on the dog, so as to prevent further attack. This animal has a soft black fur, with a rich yellow ground. The natural odour of the fur is unpleasant, but processes have recently been adopted which effect its removal: 150,000

Hosted by Google

to 200,000 of these skins are annually sold in the London fur markets. The finest are obtained in Scotland. More than 25,000 are exported yearly from this country to America, where the fur is much sought after.

THE PINE MARTEN (*Mustela Abietum*, Ray). — Found abundantly in the forests of Northern Europe and America. It shuns the habitations of man, and preys on birds and the smaller animals—mice and hares. When its retreat is cut off, it shows its teeth, sets up its hair, arches its back, and hisses like a cat. Upwards of 100,000 Pine Marten skins are annually imported into England from the territories of the Hudson's Bay Company and Canada.

THE BEECH MARTEN (*Mustela Foina*).—This animal has a white throat, and is thus distinguished from the Pine Marten, the throat of which is yellow. It is found in woods and forests in Northern Europe, but nearer the habitations of man than the Pine Marten. It is imported in considerable quantities from the north of Europe, and is dyed to imitate sable.

THE STONE MARTEN (*Mustela saxorum*).—This animal is distributed throughout Europe. Its under fur is bluish white, with the top hairs a dark brown ; its throat a pure white, by which it is generally distinguished. The French excel in the art of dyeing this fur, and for that reason it is frequently sold under the name of French sable.

THE TARTAR SABLE (*Mustela Siberica*).—This little animal is caught in the northern parts of Russia and Siberia. The fur is bright yellow, the colour being remarkably uniform all over the body. The skin is used both in its natural state and dyed ; the tail is employed for artists' pencils. In 1856 we imported as many as 70,000 skins of this animal.

THE WOODSHOCK, or PEKAN (*Mustela Canadensis*).—The pekan inhabits North America, and is also called Hudson's Bay Sable. As the natural colour of this skin is much lighter than the prevailing taste, it is dyed of a darker hue. Thus treated, it is scarcely inferior to the Russian sable, which it

Hosted by Google

is intended to imitate. We import annually about 18,000 of these skins.

THE SKUNK (*Mephitis Americana*) is common in North America, especially in the States of Pennsylvania and New Jersey. It is well known for its power of ejecting, when hunted, from a small bag placed at the root of the tail, a very offensive fluid, which produces one of the most powerful and intolerable stenches in nature. This animal is allied to the polecat of Europe. Its fur is soft and black, with two white stripes running from head to tail. The fur is purified by exposure to heat. The Hudson's Bay Company send to Europe annually about 10,000 skins, which are mostly exported to other parts of the world.

THE AMERICAN OTTER (*Lutra Canadensis*) is aquatic in its habits, and lives principally upon fish, which it pursues in the water. The colour of the fur changes with the seasons: in summer it is short and almost black, but, on the approach of winter, it alters to a beautiful reddish-brown. The motions of the otter in the water are very easy and graceful. The short, close, fine fur keeps the body at a proper temperature, and the short legs, webbed feet, and rudder-like tail enable it to move swiftly in any direction in pursuit of its agile prey. In 1864, 21,319 otter skins, valued at £14,461, were imported into this country by the Hudson's Bay Company.

THE SEA OTTER (*Enhydra marina*).—The fur of the sea otter is thick, soft, and woolly, and much prized in Russia and China, where it is the fur of royalty; to those countries most of the skins are exported. The animal is found in the North Pacific, from Kamtschatka to the Yellow Sea, on the Asiatic coast, and from Alaska to California, on the American coast. It is a rare animal, and not more than 1,000 skins are annually procured. In 1864 we imported 641, valued at £7,891. The sea otter haunts sea-washed rocks, lives mostly in the water, and approximates to the seal in its habits. Its fur is generally

Hosted by Google

employed for collars, cuffs, and trimmings. It is very beautiful, of a deep velvety maroon brown, the anterior parts being of a silvery grey. A fine skin of the sea otter is worth about £40, and a muff of this skin costs about twenty-five guineas.

2. *Plantigradæ.*

This group includes the Family of the URSIDÆ, or bears —heavy, stout-bodied animals, with thick limbs and a very stout tail—which inhabit the wooded and mountain districts of the arctic, temperate, and sub-temperate regions of the northern hemisphere. The commonest bear-skin in the English fur-market is that of the

BLACK BEAR (*Ursus Americanus*), which is imported into this country generally from British North America, and chiefly for military accoutrements. It is made into caps, rugs, pistol holsters, &c. In 1864 we imported 13,311 black bear skins, valued at £21,047.

The skins of the polar bear (*Thalassarctos maritimus*), the brown bear (*Ursus arctos*), and the grisly bear (*Ursus ferox*) are also imported by us in small quantities.

THE RACCOON (*Procyon Lotor*).—Indigenous to North America; frequents the sea-shore and the margins of rivers and swamps, where it lives upon small animals, birds, insects, and mollusca, with the addition of roots and succulent vegetables.

In 1864, 639,657 skins of the raccoon, valued at £74,538, were imported into the United Kingdom. Two-thirds of this number were re-exported, principally to Germany, where they are used for making hats. The hair of the upper part and sides of the body is of uniform length and colour, and is employed for the linings of coats, for rugs, &c.

THE BADGER (*Meles vulgaris*, Desmarest) is found throughout the northern parts of Europe, Asia, and America. Its habits are nocturnal, inoffensive, and slothful.

Hosted by Google

Its feet are plantigrade, and its long claws enable it to dig with effect, and burrow in the woods. It feeds on roots, earth-nuts, fruits, insects, frogs, and the eggs of birds. Its muscular strength is great, and its bite proverbially powerful. The American badger (*M. Labradoricus*) is larger than the European species. About 5,000 skins are annually sent over to this country by the Hudson's Bay Company. The long hairs are employed for making shaving brushes and painters' pencils. In Europe, badgers are hunted with dogs; in America, they are caught in early spring, whilst the ground is frozen, by pouring water into their holes.

THE GLUTTON, or WOLVERINE (*Gulo luscus*), inhabits the northern parts of the American continent. Wolverines feed chiefly upon the carcases of beasts which have been killed by accident. They are very troublesome to the Hudson's Bay trappers, for they will follow the marten hunters' path round a line of traps extending from forty to sixty miles, and render the whole unserviceable, by removing the baits, which are generally the heads of partridges or bits of dried venison. They resemble the bear in their gait, and feed well; they are generally, when caught, found to be very fat. The fur is a fine deep chestnut colour, with a dark disc on the back. About 1,000 skins are annually received in this country. The fur of the wolverine is much esteemed in Germany and Russia, and used for cloak linings, muffs, and sleigh robes.

3. *Pinnigradæ.*

This group includes the family *Phocidæ* (Latin *phoca*, a seal), and comprises the seals, sea bears, and walruses, which are found chiefly in the arctic and antarctic seas, and are of great value alike for their oil, bones, and skins. The chief hunting grounds are the fields of pack ice in the Greenland seas, and around the shores of Spitzbergen.

THE SADDLEBACK OR HARP SEAL (*Calocephalus Grœnlandicus*).—This species, which is the most important of the

Hosted by Google

Phocidæ in commerce, is at all times gregarious, but never seen to assemble in such numbers as during the months of March and April, when it takes to the ice to bring forth its young. During those months a pack of ice three miles in diameter has been calculated to have no fewer than four millions of seals upon it. Its length does not exceed eight feet. The name saddleback is given to it from an aggregation of black well-defined spots scattered over a yellowish-white ground in the form of a saddle or harp.

For the capture of this seal, especially during the breeding season, many ships are annually sent out, and the number taken yearly amounts to hundreds of thousands. The success of the sealers varies: a ship one year may obtain as many as 20,000 seals, and next year not capture a hundred. The chief art of sealing lies in finding out where the main body of seals is located; a sort of instinct directs these animals in flocks of hundreds to a common centre, where they remain in one great group till the young are capable of taking to the water.

This species is highly prized. From its blubber the Greenlander and Esquimaux procure light and heat; they cover their boats and bodies with its skin, make thongs with its entrails, a *derg* or float with its stomach, and ingeniously fashion the teeth into tips for their arrows and harpoons.

THE BLADDER-NOSE SEAL (*Stemmatopus cristatus*) inhabits, as the last, the Greenland seas, and is found in small groups of three or four. On account of the beauty of its fur and the immense amount of its blubber it is much sought after. It differs from the other species in having a thick black—in the young, delicate brown—woolly coat, which lies beneath its outside bristly hair.

THE COMMON SEAL (*Phoca vitulina*, L.) is found on the coasts of Scotland, France, and other parts of Europe. The usual haunt of this species is a hollow or cavern in a rock near the sea, and above high-water mark. They are extremely watchful, seldom sleep more than a minute, raise

Hosted by Google

their heads, and, if nothing is to be seen or heard, lie down again; but if disturbed, they instantly tumble off the rocks into the sea. They are usually shot when asleep. If surprised by the hunter at a distance from the shore, they hasten to the water, flinging stones and dirt behind as they scramble along, and expressing their fears by piteous moans. When overtaken, they make a vigorous defence with their feet and teeth until killed.

We imported from Greenland, British North America, and the United States, as well as from Norway, Russia, and other parts of Europe, in 1867, 743,511 undressed seal skins, valued at £174,998.

The skin of the seal, when tanned, is employed in the making of shoes; and when dressed by the furrier, serves for the covering of trunks, and for articles of clothing, such as caps and hats, mantles and muffs, coats and boots.

RODENTIA.

The *Rodentia* (Latin, *rodo*, I gnaw), or gnawing mammalia, are, for the most part, of small size, but numerous and prolific. They are distributed all over the world, even in Australia, which possesses some few indigenous species. They have two pairs of curved cutting or incisor teeth, which project from the front of each jaw, and from two to six molars on each side, but they are devoid of canine teeth. The rodents of the greatest value in the fur market are—

THE BEAVER (*Castor fiber*, L.).—This animal is found in Canada, where it frequents the banks of rivers and marshes, making large dams with the stems of trees plastered with mud to keep out the water, and building rude dwellings in the water, with considerable engineering skill and ingenuity. The fur of the beaver consists of two kinds of hair, one long and rigid, forming the outer coat, the other soft and downy; it is the latter which is employed for coat linings, muffs, and other articles of dress. About 80,000 beaver

Hosted by Google

skins are annually sent over to this country from North America by the Hudson's Bay Company.

THE MUSK RAT, or MUSQUASH (*Fiber zibethicus*).—This animal is a native of Canada. It is much smaller than the beaver, which it resembles in its fur and habits, and with which it associates. Above a million are annually taken by the Canadian trappers, and their skins sent over to the fur markets of this country; dressed in the same way as beaver skin, they form a cheap and durable fur for ladies' wear.

THE NUTRIA, or COYPU RAT (*Myopotamus Coypus*), inhabits South America, living near streams, and burrowing in their banks. It is smaller than the beaver, and also differs in the possession of a round hairy tail. Its skin forms a good substitute for that of the beaver, and is dressed in a similar manner. In some years one million Nutria skins have been imported from South America into the United Kingdom.

THE SQUIRREL (*Sciurus vulgaris*, L.).—Light, nimble, and graceful animals, living on the branches of trees, feeding on nuts and other hard fruits, which they gnaw through with their sharp front teeth, carefully removing every particle of skin from the kernel before eating it. Squirrels are distributed through all parts of the world except Australia, but are especially abundant in North America. Their skins are used entirely for ladies' and children's wear, and are sent in enormous numbers to our fur markets under the name of *Calabar*. About 2,000,000 are annually imported. The fur is sometimes dyed to imitate sable. The tail is used in the manufacture of boas and artists' pencils. Besides the common squirrel; *Sciurus cinereus*, the grey squirrel; *S. niger*, the black; *S. Caroliniensis* and *S. Hudsonius*, the American red squirrel, yield useful and ornamental furs.

THE CHINCHILLA (*Chinchilla lanigera*).—An elegant, active little animal, inhabiting the Andes of South America, in Chili and Peru, and living at a considerable altitude. The posterior legs are longer than the anterior, and the animal when feeding sits upon its haunches, holding its food be-

Hosted by Google

tween its short fore-paws. The ears are very large and broad. The fur, which is very thick, soft, and of a greyish colour, reaches us through the South American markets. Chinchilla fur is greatly admired for winter clothing, and is made into muffs, mantles, boas, cloak linings, trimmings, and other articles for ladies' and children's wear.

THE HARE (*Lepus timidus*) and RABBIT (*Lepus cuniculus*). —The skin of the rabbit, when dressed and dyed, is made into all sorts of cheap and warm winter clothing; that of the hare is frequently worn over the chest as a protection against external cold. We have large supplies of rabbit skins sent to our markets from the rabbit warrens of Norfolk, the Orkney and Shetland Islands, and Ostend. Upwards of 1,000,000 rabbits are sold yearly in London, and more than a quarter of a million of hare skins are annually imported into this country from Russia, Germany, Denmark, Friesland, Poland, Wallachia, Turkey, Greece, and Sicily. The best and the greatest number come from Russia.

RUMINANTIA.

The animals of this order are distinguished from the other mammalia by the remarkable facilities which they possess for ruminating, or chewing their food twice over. In the majority the lower jaw alone is furnished with incisor teeth, their place in the upper jaw being occupied by the hardened gum. The molars are separated from the incisors by a considerable gap in the jaw. Examples: sheep and deer.

THE AMERICAN BUFFALO, or BISON (*Bison Americanus*, L.) —Vast herds of buffaloes roam over the western prairies of North America, and hundreds of thousands of them are annually killed. Buffalo robes are much esteemed in America as sleigh coverings; about 70,000 are annually made up and sold in New York. During the Crimean war our soldiers found these robes of great service; about 20,000 buffalo robes were furnished by the English Government amongst other army supplies.

Hosted by Google

The skin of the LAMB is made into collars, muffs, gloves, and coat linings. The most valued of these skins are furnished by Southern Russia, Greece, and Hungary. Beautiful black lamb skins are imported from the Crimea, and others still more rich and glossy, with a short fur, from Astracan. The lamb skins from Persia are known by the curl of the hair, which is produced artificially by tying up the lamb, as soon as born, in a leathern skin, and thus preventing the hair from expanding. These Persian lamb skins are used for coats and other garments.

The skin of the fœtal CALF is used for covering trunks.

The principal fur marts for the English or Canadian furs are London, in Upper Canada; Fort William, on Lake Superior; and in Lower Canada, Montreal, on the river St. Lawrence.

II.—PERFUMES.

THE MUSK DEER (*Moschus moschiferus*, L.; order, *Ruminantia*).—This animal, which furnishes the well-known perfume called musk, is about the size of a roebuck, without horns, legs very slender, and in all its movements exceedingly active and graceful. The musk deer is found in herds in the mountains of Central Asia, and in some of the larger islands of the Indian Ocean, such as Ceylon, Java, Sumatra, and Borneo. It is a shy animal, fond of precipices and almost inaccessible crags, and therefore very difficult to shoot. The musk is produced in a glandular pouch in the abdomen, and is peculiar to the male. It is in the form of reddish-brown coarse granules, and greasy to the touch. The average quantity which can be removed from one pouch is about 190 grains.

Musk is known in commerce under two forms—as Tonquin or Thibet musk, which is the most valuable, and Siberian, Kabardinian, or Russian musk, of inferior quality. The Oriental or Tonquin musk from Cochin-China and Tonquin, is imported in small oblong rectangular boxes, which

Hosted by Google

are lined with lead, to prevent the escape of the odour; the musk bags, wrapped in thin blue or red paper covered with Chinese characters, are placed in these boxes. These musk bags are usually covered with hairs, which all converge towards the little narrow opening in the bag. The weight of each bag varies, some not exceeding half an ounce, whilst others weigh upwards of two ounces. Large numbers of musk deer are annually killed. The annual import of musk into the United Kingdom is upwards of ten thousand ounces.

Besides its uses as a perfume, musk also possesses valuable remedial qualities. When genuine, it is one of the most powerful of the antispasmodics, and is applied with advantage in cases of infantile spasms, when not accompanied with inflammation.

CIVET CAT (*Viverra civetta*, Gm.; order, *Carnivora*).—A native of northern Africa, and especially common in Abyssinia, allied to the pole-cat and marten. Body from two to three feet long, and from ten to twelve inches high; tail half as long as the body. This animal yields a perfume which is thus obtained:—The civet, when captured, is enclosed in a small cage, in which it cannot turn round, and while thus confined, the secretion is removed from its large anal pouch two or three times a week with a spoon or spatula. The interior of the pouch is glandular, the glands secreting the perfume from the blood of the animal. The substance itself is of a pale yellow colour, and of the consistence of honey. It is not unlike musk, and to most persons smells disagreeably, but when mixed with butter, wax, lard, and alcohol, in the proportion of one part to a thousand, it loses its offensive character, and becomes aromatic and delicately fragrant. Thus prepared it is used in perfumery, and when employed, renders more perceptible other scents with which it is mixed. Lavender and other scented waters become more agreeable by the addition of minute quantities of civet. The substance is not so much

Hosted by Google

in use now as formerly, nevertheless, there is still a considerable consumption of it in this country, and as much as forty shillings an ounce is paid for it.

Viverra zibetha is another species of civet cat, peculiar to the Asiatic continent, and found from Arabia to Malabar, and in the larger islands of the Malayan Archipelago. It is much milder in its disposition than the African species, and is domesticated by the Arabs and Malays. Our supplies of civet are also derived from this animal, although to a less extent than from the African species.

Castoreum, which strongly resembles musk in its medicinal qualities and applications, is furnished by the BEAVER (*Castor fiber*, L.) This substance is secreted in the interior of a little bag or pouch, with which the beaver is supplied. It is brought to market, like the musk, in the pouch. The best *Castoreum* is that from Russia and Siberia; a very good quality is furnished also by Poland, Prussia, Bavaria, Germany, Sweden, and Norway; an inferior kind comes from Canada and the territories of the Hudson's Bay Company.

AMBERGRIS.—This substance is obtained from the sperm whale. It is an expensive drug, because not frequently found, and is valued on account of the excellency of its fragrance. Ambergris is a morbid or diseased concretion formed in the stomach, or probably in the gall-ducts, of the sperm whale, in masses of considerable size, sometimes weighing thirty or forty pounds. It is usually found floating on the surface of the water, probably disengaged from the floating body of one of these monsters, and is rarely sought for in the intestines of the sperm whale, although it is worth a guinea an ounce. It is fished up in the Indian Ocean, near the Moluccas and Philippine Islands; also near Sumatra, Madagascar, and on the coast of Coromandel. In the Atlantic Ocean it is found near the West Indies and the Brazils. Ambergris is used as a costly frankincense, principally for perfumes, especially in France. It has also the property

Hosted by Google

of increasing the power of other perfumes when mixed with them, and it is principally for this purpose that it is used.

III.—STEARINE AND OILS.

The chief supply of animal oil is derived from various species of seals (order *Carnivora*, family *Phocidæ*) and whales (order *Cetacea*).

In order to meet the needs of the creature it defends, the true skin of whales is modified, forming the layer of blubber, called by whalers the blanket, probably in allusion to its office of preserving the animal heat. The blubber is composed of a number of interlacing fibres, capable of containing a very large quantity of oily matter. The thickness of the blubber varies in the several species; those inhabiting the frigid zones have it of greater thickness than those which habitually live in warmer seas. It is never less than several inches, and in many parts of a whale is two feet deep, and, moreover, as elastic as caoutchouc, offering an admirable buffer to the force of the waves and the pressure of the water, as well as a defence from cold. In a large whale the blubber will weigh thirty tons.

The species of whales that are regularly hunted for the sake of their oil are:—

THE GREENLAND WHALE (*Balæna mysticetus*).—Confined to the Greenland and Spitzbergen seas, its migrations being regulated by the extent of the perpetual ice.

THE HUMP-BACKED WHALE (*Megáptera longímana*) attains a length of sixty to seventy feet, and inhabits the Greenland seas, where it is found in great abundance. Though its oil is said to be superior to that which is furnished by the Greenland whale, and not much inferior to the oil of the sperm whale, yet it is not eagerly sought after.

THE PIKE, or FINNED WHALE (*Balænoptera rostrata*) is a native of the seas that wash the shores of Greenland, and is sometimes seen near Iceland and Norway. The flesh is in some repute as a delicacy among the natives of these

Hosted by Google

northern regions. The oil which it furnishes is said to be particularly delicate.

SPERM WHALE (*Cátodon macrocéphalus*).—This species, which measures from seventy to eighty feet in length, is chiefly notable on account of the valuable substances which are obtained from its body—oil, spermaceti, teeth, ambergris. It differs from the true whales in having no baleen plates in the palate, but from forty to fifty conical teeth in the lower jaw, which fit into cavities in the upper, so that the mouth is capable of being completely closed. The head is of an enormous size, forming about one-third of the entire length of the animal. It is cylindrical, truncated, not composed of a bone, but of a sort of cartilaginous envelope, containing an oily fluid, which hardens by exposure to the air, and is then known as *spermaceti*. This substance is also diffused through the blubber.

The sperm whale, or cachelot, is generally distributed in all seas, but principally in those of the southern hemisphere.

The oil is obtained from the blubber, which is only fourteen inches in depth on the breast, and eleven inches on the other parts of the body, and is therefore not so abundant in proportion to the size of the animal as that which is extracted from the Greenland whale. Its superior quality, however, compensates fully for its deficiency in quantity. It is much used for burning in lamps.

The spermaceti from the head is very valuable as an ointment, and for the manufacture of candles. The United States fit out more ships than any other nation for this whale fishery, bringing home annually more than 200,000 casks of train oil, and 150,000 casks of spermaceti. Next to the United States, England is the country most engaged in the whale fisheries, the principal port, Hull, having about 200 ships. France employs 145 ships in this business, the principal port being Havre. Norway, Sweden, Denmark, and the Hanseatic towns take some part in the whale fisheries, though not to any very great extent.

Hosted by Google

Spermaceti candles are mostly manufactured in England. Spermaceti is imported from the United States; the value per ton in 1866 was £123 15s. 6d.

THE BELUGA (*Beluga cátodon*), also called the White Whale, on account of the colour of its skin, is an inhabitant of the higher latitudes, being found in great numbers in Hudson's Bay and Davis's Straits, and frequenting the mouths of large rivers on the northern coasts of Asia and America. The oil furnished by the Beluga is of very good quality, although small in quantity, and is sufficiently valuable to have led to the establishment of regular Beluga hunts in the great North American rivers, which they ascend for some distance in search of prey. The skin can be made into a peculiarly strong tough leather, and is said to resist an ordinary musket-ball.

THE SEALS, which have been described in pp. 274–5, are also hunted for the sake of their oil; and the pursuit of them is superseding that of the Greenland whale, for the latter has been greatly reduced in numbers by continued persecution at the hand of whalers for upwards of one hundred years past.

A large number of British vessels are engaged each year in the capture of whales and seals; and the importation of train or blubber oil from British North America for 1867 was 15,945 tuns, the average for the last fifteen years being, however, 20,000 tuns. The price per tun in 1866 was £44 11s. 10d.

TALLOW.—This is an article of great commercial value. It is animal fat separated from membranous matter by fusion, and consists chiefly of stearin, with a small quantity of olein. It is manufactured into candles and soap, and is extensively used in dressing leather, and in various other processes in the arts. We are supplied extensively with native tallow, and we annually import a large quantity, principally from Russia, Hungary, and Turkey—altogether about 30,000 tons a year. Our imports of tallow from

Hosted by Google

Australia and the Argentine Confederation average also from 2,000 to 3,000 tons annually. The entire imports from all parts were—in 1865, 3,125,282 cwts.; in 1866, 3,008,807 cwts.; and in 1867, 2,419,594 cwts. respectively.

The tallow we receive from Australia is chiefly obtained from sheep, the carcases of which are boiled down for this product alone; that from South America is from oxen and even horses, which roam in a half-wild state over the grassy plains of Monte Video, La Plata, &c. The animals are slaughtered for their hides, tallow, and bones.

IV.—FOOD PRODUCTS.

BUTTER is extensively made in the counties of Cambridgeshire, Suffolk, Yorkshire, Somerset, Gloucestershire, Oxfordshire, and Essex. In Scotland excellent butter is made in Clydesdale and Aberdeenshire. The butter produced in Great Britain is, however, insufficient for home consumption, and large quantities are imported, principally from Ireland, where it is a staple commodity; and from Holland, Belgium, the Hanse Towns, France, and the United States. The foreign imports for last year were 1,142,262 cwts.

CHEESE is the curd of milk compressed into solid masses of different sizes and shapes, salted and dried, and sometimes coloured and flavoured. Besides our own supply of Gloucester, Wiltshire, Cheshire, and Stilton cheeses, which are the most in demand, we import a considerable number of foreign cheeses, amongst which are Limburg cheese from Belgium, Swiss cheese from Switzerland, Parmesan cheeses from Parma and other places in Lombardy, American cheeses from the United States, Edam and Gouda cheeses from Holland, and German cheeses from Westphalia. The last come to market made up into round balls, or short cylinders, under a pound weight each.

The rich flavour of Parmesan cheese is owing to the

Hosted by Google

aromatic plants which abound in the Italian pastures. Stilton cheese, so named from the town in Huntingdonshire where it was first brought into notice, is the dearest of all English cheeses, the price being generally to that of Cheshire as two to one, or two to one and a quarter. To produce premature decay, and consequently an appearance of age, in these cheeses, the manufacturers are said to bury them in masses of fermenting straw; also to spread the curd out on the ground over night, by which it becomes sooner liable to the blue mould. The quantity of cheese of all kinds imported during the year 1867 was 905,476 cwts., the principal countries which supplied us being Holland and the United States.

LARD.—The melted fat of swine is imported chiefly from the United States. In 1867 we received 246,839 cwts., of the average value of £3 9s. per cwt.

LIVE STOCK.—*Oxen.*—The numbers imported were—in 1865, 283,271; in 1866, 237,739; in 1867, 177,948 respectively. The average price per head in 1867 was £17 19s.; and the principal countries whence imported were Schleswig, Holstein, and Holland.

Sheep and Lambs, principally imported from Holland, amounted, in 1865, to the number of 914,170; in 1866, 790,880; in 1867, 540,326, of the average price per head, in 1867, of £2 10s.

MEATS.—*Bacon and Hams.*—The imports in 1863 were as much as 1,877,813 cwts., since which year the importation has been on the decline; in 1867 the number of cwts. was only 537,114, of the value of £1,391,779. The greatest supply was from the Hanse Towns and the United States.

Beef (salted).—The imports, chiefly from the Hanse Towns and the United States, were, in 1867, 246,767 cwts., of the value of £623,392.

Pork (salted), not including hams, is imported from the Hanse Towns and the United States; the quantity which

Hosted by Google

was received in 1867—150,285 cwts., of the computed real value of £351,871—is much below the annual average.

Preservation of Meat.

How to meet the growing demand for butcher-meat, consequent on an increase of population and a decrease of stock, arising in great measure from pasture-lands being brought under tillage, is a question of grave importance in relation to the commercial prosperity of this and other countries, and calls for the earnest attention of legislators and scientific men. Though the stock of sheep and cattle raised in England is large, and that of cattle in Ireland and Scotland is a source of wealth to those two countries, yet enormous quantities of meat are imported. When we turn our attention to Australia and the Argentine States, we find the flesh of cattle and sheep sacrificed for other parts of the animal; and he who shall devise a method by which these meats can be economically imported into this country will be hailed as one of the greatest public benefactors of the age. The importation of the living animals seems out of the question, notwithstanding the arrival of one or two cargoes; and, as the jerked or sun-dried beef, though brought in at low rates from Monte Video, &c., has not found favour, there only remains the discovery of a process by which the meat can be preserved in a fresh state a sufficient length of time to admit of its transportation from regions so distant.

This art of preserving meat is one of modern times, and differs entirely from the old and common methods by means of salt, saltpetre, sugar, &c. These substances, when in solution, do not absorb oxygen, and therefore they prevent decomposition. The history of the art of preserving meat in a fresh state is associated with the earliest arctic explorations. Scientific observers found that scorbutic diseases arising from living exclusively on salt meat were fearfully aggravated by extreme cold; the Admiralty, there-

Hosted by Google

fore, offered inducements to merchants to devise plans for preserving unsalted meat, cooked, or in a raw state, thus doing away with the use of salt meat altogether. It is hardly possible to over-estimate the importance of this subject, as is evident from the fact that preserved provisions, cooked or raw, are an absolute preventive of sea scurvy.

M. Appert, a French gentleman, was the first to succeed in the attempt to preserve unsalted or fresh meat, and in 1810 he received a prize of 12,000 francs from the Parisian Board of Arts and Manufactures. In the following year, M. Durant, a colleague of M. Appert, took out, in this country, a patent, which was subsequently purchased by Messrs. Donkin, Hall, and Gamble, for £1,000.

M. Appert's process consisted in partly cooking the meat, placing it in a glass vessel in a bath of chloride of calcium, heating it to about 240° F., and then hermetically sealing the lid. Appert's plan, as adopted and improved by Messrs. Donkin, Hall, and Gamble, is as follows:—Tin canisters are substituted for the glass vessels, and the meat (previously parboiled) is placed in them, with a rich gravy or soup. The lids, which are pierced with a small hole, are then soldered down air-tight, and the canisters immersed in a bath of brine or chloride of calcium, heated to boiling point. On the steam issuing from the hole in the canister lid, it is suddenly condensed by the application of a cold wet rag, and a drop of molten solder being dexterously applied to the hole at the same moment, the case becomes hermetically sealed. On cooling, the ends of the canisters are slightly concave, from atmospheric pressure, if the process has been successful; but if the ends have flattened, or become convex instead of concave, then either the case has not been properly soldered and is not air-tight, or the meat has decomposed and liberated gases.

As soon as this modification of Appert's process was made practically perfect, it was tested by order of the Admiralty, and ships were sent by them to the arctic

Hosted by Google

regions with an abundant supply of these meat canisters. The officers in command reported favourably of the whole. Their value in cold climates having thus been proved, the experiment was tried with equal success by vessels trading in the tropical regions. For ship use these preserved meats are invaluable, and hardly a vessel now leaves this country without a supply. In India they are extensively used as luxuries in the towns, and as necessaries in the remote districts, where fresh meat of any kind is scarce and bad. It may be noted here that most of the ocean steam-ships belonging to ports of the United States and Europe are provisioned with fresh meats conserved in ice.

V.—WOOL.

In commerce this term is applied to the hair of the alpaca, goat, beaver, and rabbit, and to allied substances; but, strictly speaking, it belongs to the sheep alone, the hair of which, from time immemorial, has been woven into cloth.

Wools are divided into two great classes—clothing wools and combing wools, or short wools and long wools; and the fabrics woven from them are termed woollens or worsteds, according as the one or the other is employed. The fibres of clothing wools felt or interlace with one another, forming thereby a dense compact material, suitable for warm and heavy clothing; these wools are manufactured into broad cloths, narrow cloths, felt for hats, blankets, carpets, serges, flannels, and tartans. Combing wools, on the contrary, though long in fibre, do not felt, and are therefore employed in the manufacture of light and loose, but still warm garments—such as stuffs, bombazines, merinos, hosiery, camlets, and shawls, and various mixed goods, as damasks, plushes, and velvets.

The wool of the sheep has been greatly improved since the animal has been brought under the fostering care of man. The *mouflon*, which is considered by some zoologists as the parent stock of the common domestic sheep, inhabits

Hosted by Google

the mountains of Sardinia, Corsica, Greece, Barbary, and Asia Minor. This animal has a very short and coarse fleece, more like hair than wool. When domesticated, the rank hair disappears, and the soft wool around the hair-roots, which is hardly visible in the wild animal, becomes singularly developed. If sheep are left to themselves on downs and moors, there is a tendency to the formation of this hair amongst the wool; its occurrence in the fleece of domestic sheep is therefore rare, and is always regarded as proving defective sheep-farming.

The climate of this country is unfavourable to the growth of the best wools; hence the superiority of the Merino, Saxony, and Australian wools, the produce of countries having a higher average temperature. Merino wool is obtained from the migratory sheep of Spain, a breed distinguished from the British by bearing wool on the forehead and cheeks; the horns are large, ponderous, and convoluted laterally; the wool is long, soft, and twisted into silky-looking spiral ringlets, and is very superior in its fineness and felting properties. Its closeness and a luxuriant supply, from the glands of the skin, of yolk or natural oil, which serves to nourish it and mats the fibres together, renders it an excellent natural defence against the extremes of heat and cold. These migratory sheep, amounting in Spain to 10,000,000, are led twice a year (in April and October) a journey of 400 miles, passing the summer in the pastures on the slopes of the Pyrenean mountains, and the winter on the plains towards the south.

The word *merino* signifies an overseer of pasture lands, and is applied to these sheep because in Spain they travel in detachments of 10,000 each, under the care of fifty shepherds and as many dogs, with a mayoral or chief shepherd at their head, and have a general right of pasturage all over the kingdom. "Several of the sheep are tamed and taught to obey the signals of the shepherds; these follow the leading shepherd (for there is no driving), and

Hosted by Google

the rest quietly follow them. The flocks travel through the country at the rate of eighteen to twenty miles a day, but, in open country, with good pasturage, more leisurely. Much damage is done to the country over which these immense flocks are passing; the free sheep-walk which the landed proprietors are forced to keep open interferes with enclosure and good husbandry; the commons, also, are so completely eaten down that the sheep of the neighbourhood are for a time half-starved. The sheep know as well as the shepherds when the procession has arrived at the end of its journey. In April their migratory instinct renders them restless, and if not guided, they set forth unattended to the cooler hills. In spite of the vigilance of the shepherds, great numbers often escape; if not destroyed by the wolves, there is no danger of losing these stragglers, for they are found in their old pasture, quietly awaiting the arrival of their companions." *

This celebrated breed is now reared in Saxony and in Australia, which has become one of the principal wool-growing countries in the world. In 1464 Spain imported ewes and rams from the Cotswold hills.

The Cretan or Wallachian sheep, remarkable for the enormous development and magnificent formation of its horns, possesses a fleece composed of a soft woolly under-coat, covered with and protected by long drooping hairs. The wool is extremely fine in quality, and is employed in the manufacture of warm cloaks, which are largely used by the peasantry, and which are so thick and warm that they defend the wearer against the bitterest cold.

The chief countries which supply us with sheep and lambs' wool are Russia, Hanse Towns, Argentine Confederation, British possessions, Africa, British India, and Australia. The quantity—including that of Africa—imported in 1867 was 233,703,184 lbs.

* "Cyclopædia of Useful Arts and Manufactures." By Charles Tomlinson. Vol. 2, p. 1,030.

Hosted by Google

There are other ruminant animals from which the wools of commerce are obtained besides the sheep. The following are the chief of these :—

ANGORA GOAT (*Capra Angorensis*, Hasselq.).—It inhabits the mountains in the vicinity of Angora, in Asia Minor. In colour it is milk white ; legs short and black, horns spirally twisted and spreading ; the hair on the whole body is disposed in long, pendulous, spiral ringlets, and is highly valued in Turkey, the finest and most costly Turkish robes being manufactured from the fleece, which is as soft and fine as silk. It was first brought into the markets of Europe under the name of Mohair. Its exportation, unless in the shape of yarn, was formerly prohibited, but it is now allowed to be exported unspun. Mohair is transmitted to England chiefly from Smyrna and Constantinople. It is manufactured into fine shawls, camlets, velveteens, plushes, braidings, decorative laces, and trimmings for gentlemen's coats. The manufacture is principally carried on at Bradford and Norwich. In 1864, 4,737,330 lbs. of mohair, valued at £650,191, were imported into the United Kingdom.

THIBET GOAT (*Capra hircus*).—The costly and beautiful Cashmere shawls are made from the delicate downy wool found about the roots of the hair of this animal, which inhabits the high table lands of Thibet, where these shawls are manufactured. These oriental fabrics are woven by very slow processes, and are therefore very expensive, being sold in Paris at from 4,000 to 10,000 francs a-piece, and in London at from £100 to £400. "The wool is spun by women, and afterwards coloured. A fine shawl, with a pattern all over it, takes nearly a year in making. The persons employed sit on a bench at the frame—sometimes four people at each ; but if the shawl is a plain one, only two. The borders are worked with wooden needles, there being a separate needle for each colour, and the rough part of the shawl is uppermost whilst it is in progress of manu-

Hosted by Google

facture."* To the people of Cashmere this manufacture is very important; about 16,000 looms are continually at work, each one giving employment to three men. The annual sale there is calculated at 30,000 shawls.

It has long been the aim of European nations, on account of the beauty and value of these shawls, to imitate them, if possible, and apply to their manufacture the more speedy and elaborate methods which modern science has placed within our reach. The French have been most successful, and shawls are now produced at Paris, Lyons, and Nismes, known in commerce as French cashmere, which closely approximate in stuff and style of work to the oriental, while much lower in price, although still costly. Norwich, Bristol, Paisley, and Edinburgh have also manufactured very good imitations of these shawls. The Cashmere wool imported for this purpose comes into Europe through Kasan, on the eastern bank of the Volga, and also directly from India and Persia.

The quantity of goat's hair or wool imported in 1867 was 2,648,360 lbs.; the imports of the same material manufactured were of the value of £127,093.

ALPACA (*Llama Pacos*, Gray).—The llamas may be regarded as the camels of South America, to which tribe of animals they belong. They inhabit the slopes of the Peruvian Andes, and the mountains of Chili, keeping together in herds of from 100 to 200, and never drinking when they have a sufficiency of green herbage. The alpaca is about the size of a full-grown deer, and very graceful in appearance. Its fleece is superior to that of the sheep in length and softness, spins easily, and yields an even, strong, and true thread. Pizarro found this animal used as a beast of burden, and its wool employed for clothing by the natives of that country.

Alpaca wool arrives in this country in small bales called

* *See* "Naturalist's Library." *Ruminantia*, Part 2. By Sir W. Jardine, Bart.

Hosted by Google

ballots, weighing about 70 lbs., and generally in a very dirty state. It is sorted into eight different varieties, each fitted for a particular class of goods, and then washed and combed by machinery. The principal articles manufactured from it consist of alpaca lustres, fancy alpacas, and alpaca mixtures. Nearly all the alpaca wool imported into England is worked up in the Bradford district. In 1863 our imports from Peru were 2,772,836 lbs.; from New Granada, 622,889 lbs.; and from other places in South America, 6,857 lbs.

The *Llama vicuña* and *L. guanaco*, other species of these animals inhabiting the same regions, yield fine hair, but at present of little commercial value.

In 1867 we imported 233,703,184 lbs. of wool (sheep, lamb, and alpaca) from Europe, South America, South Africa, the East Indies, and Australia. Our exports of wool in 1867, to foreign countries and our colonial possessions, amounted to 90,832,584 lbs.

The best wool is grown in Germany, which annually produces 67,200,000 lbs. The finest kind passes in commerce under the name of Electoral Wool. Next to Germany, Australia ranks in importance as a wool-growing country; the merino breed of sheep has been introduced there with unexampled success. In 1807 the first importation of Australian merino wool was received in England, amounting to only 245 lbs. It has now grown to national importance, amounting in 1869 to 160,000,000 lbs., valued at £9,000,000 sterling. Probably a more extensive and instructive collection of wools was never brought together than that contributed to the Great Exhibition of 1851, in this country; showing, in a remarkable manner, the extent to which wool-bearing ruminants have been fostered by man, their wide geographical diffusion, and the influence of climate in modifying the characters of their fleeces. Samples of wool were there for inspection and comparison, from Chinese Tartary, Thibet, and India in the East, to the

Hosted by Google

lately redeemed tracts of the United States in the far West; and from Iceland and Scandinavia in the North, to the Cape of Good Hope and Australia in the South.

Although Europe now surpasses oriental nations in the artistic working of cotton and silk, yet the same cannot be said of the manufacture of shawls and carpets; for, besides the cashmere shawls made at Kashmir, in the kingdom of Lahore in Thibet, and also at Delhi in British India, carpets of peculiar and unequalled beauty still come exclusively from Persia and the Levant.

VI.—LEATHER.

Leather is an animal skin chemically changed by the process called tanning. The skin is prevented from putrefying, and rendered comparatively impervious to water, by the vegetable astringent, tannin, found in the bark, fruit, and leaves of various plants; this uniting with the gelatine of the skin, forms a tannate of gelatine. The skin, thus changed, was called by our Saxon ancestors "lith," "lithe," or "lither"—that is, soft or yielding, whence our term "leather."

The skins are first cleansed from hair and cuticle, by being soaked for several days in a pit of lime water; this loosens the hair and cuticle, so that it is easily scraped off with a curved knife, upon a half cylinder of wood, called a beam. The hair thus removed is sold to plasterers, who use it in their mortar. The skins are now steeped for a few days in a sour liquor of fermented rye or barley, or in weak sulphuric acid. By this process, called "the raising," the pores are distended and rendered more susceptible of the action of the tan. The skins are then put into the tan-pit, in alternate layers, with crushed oak bark, valonia, catechu, divi-divi, and other vegetable astringents, and the pit is filled with water. As the tannin is taken up by the skins, it becomes necessary to empty the tan-pit, and add fresh supplies of tanning material and water. The time required

Hosted by Google

to tan the skins, or transform them to leather, depends on their thickness and other circumstances, and varies from four months to two years. When fully tanned, the leather, if cut through, is of a uniform brown colour—anything like a white streak in the centre showing incompleteness in the process. It is now stretched upon a convex piece of wood called a "horse," beaten and smoothed, or passed between cylinders to make it more solid and supple, and lastly, dried by suspension in an airy covered building.

Tanned leather often undergoes the further operation of currying, or impregnation with oil. Leather, prepared as already described, when it is received by the currier is by him rendered smooth, shining, and pliable, so as to make it suitable for the purposes of the shoemaker, coachmaker, saddler, and harness-maker. First it is soaked in water to render it pliable, then stretched upon the beam and shaved smooth with a knife, next rubbed with a polishing stone, and while still wet besmeared with a mixture of fish-oil and tallow, and hung up in a loft to dry. As it dries, the water only evaporates, the oil penetrating the pores of the leather. The grain, or hair side, is then blackened with copperas water, or sulphate of iron in solution, the iron uniting with the gallic acid of the tan, and producing an inky dye, or a gallate of iron. Leather so prepared is chiefly used for the uppers of ladies' shoes. Leather for the uppers of men's boots and shoes, on the contrary, is blackened on the flesh side, or waxed, as it is termed, with lampblack and oil, which is thoroughly rubbed in with a hard brush. The thick leather for the soles of boots and shoes is simply tanned without being curried.

But leather can be made without tannic acid. Skins may be preserved by means of alum and salt, and leather so made is called in the trade "tawed leather," and is quite as durable and much softer. Gloves are usually made from tawed leather. Skins intended to be tawed pass through a series of preliminary operations, resembling those by which

Hosted by Google

skins are made ready for tanning (the use of ordures is, however, indispensable). They are then immersed in a solution of alum and salt, to which, for the superior kinds of leather, flour and yolk of eggs are added. They are next dried in a loft, smoothed with a warm iron, and then softened on a stake, when they are dyed of various colours for gloves and ladies' boots. The French are skilled in this art. At Annonay, a town about fifty miles from Lyons, tawing operations are carried on so largely that 4,000,000 of kid skins are dressed there annually. It has been computed that France and England consume 6,000,000 of eggs yearly in preparing kid leather. These eggs are kept in lime-water by the leather dressers, to preserve them until they are wanted. The average quantity of leather gloves annually made in the United Kingdom has been estimated at 12,000,000 pairs. We import also largely from France. In 1867, 10,893,780 pairs were received from that country. The imports of tanned and untanned hides in 1867 were 975,168 cwts.

The leathers known in commerce as CHAMOIS and BUFF LEATHER, are prepared much in the same way as tanned and tawed leather, only that oil is substituted for the alum and tannic acid. The skin of the chamois is not always used; more frequently sheep and doe skin. Wash leather is an example of this kind of preparation.

RUSSIA LEATHER, the smell of which is so agreeable, is prepared in the usual way, then tanned with the bark of the willows (*Salix cinerea* and *Salix capræa*), and afterwards curried with the empyreumatic oil from the bark of the birch tree, which imparts to it its peculiar odour. M. Chevreul, who investigated the chemical nature of this odoriferous substance, called it *Betuline*.

MOROCCO LEATHER of the finer qualities is made from goat skins tanned with sumach, and inferior morocco, or roan, from sheep skins. The hair, wool, and grease are removed as usual, and the skin, thoroughly cleansed, is

Hosted by Google

reduced to the state of simple membrane, called pelt. Each skin is then sewn by its edges into the form of a bag, the grain, or hair side, being outwards. A strong solution of sumach having been put into the bag, it is distended with air like a blown bladder, and the aperture tied up. About fifty of these skins, so distended, are thrown into a tub containing a warm solution of sumach—the tanning liquor—in which they are allowed to float. In a few hours they are tanned, removed from the bath, the sewing is then undone, and they are scraped and hung up in the drying loft. Red morocco leather derives its colour from cochineal, which, boiled in water with a little alum, forms a red liquor, in which the skins are immersed before being put into the sumach bath. In the case of black morocco, the skins are sumached without any previous dyeing, and the black colour is given by applying with a brush, to the grain side, a solution of red acetate of iron; blue is communicated by indigo; puce colour by logwood, with a little alum; green is derived from Saxon blue, followed by a yellow dye made from the chopped roots of the barberry; and for olive, the skins are first immersed in a weak solution of green vitriol, and then in a decoction of barberry root, containing a little Saxon blue.

The thickest and most substantial leather now in general use is that made from the hides of the wild horses found throughout the Pampas in South America. It is employed for the soles of boots and shoes, harness, saddlery, leather trunks, hose for fire engines, pump valves, military gloves and belts. Deer skins are used for the finer kinds of morocco leather, and for bookbinding. Calf skins, tawed, are used by bookbinders; tanned and curried, by boot and shoemakers. Sheep skins, simply tanned, are employed for inferior bookbinding, for leathering bellows, and other purposes where a cheap leather is required. Morocco leather is used for coach linings, for covering chairs and sofas, bookbinding, pocket-books, &c. A thin leather called

Hosted by Google

skiver, is used for hat linings. There is an immense demand for thin leathers, and machinery for this purpose is now constructed with such accuracy that it will split a sheep skin into three parts. The grain side of the skin is then used for skiver, the middle for vellum and parchment, and the flesh side is transferred to the glue maker. On parchment we inscribe our deeds, and on vellum all our state documents.

The leather manufacture of Great Britain is of great importance, and ranks next in value and extent to those of cotton, wool, and iron. The census of 1851 showed that 350,000 persons were engaged in the different branches of the leather manufacture, and its entire annual value has been computed at more than £20,000,000 sterling, the leather for boots and shoes alone being valued at £12,000,000. Most of the leather made in the kingdom, and the articles manufactured from it, are used at home. Our exports are, however, considerable, and in 1867 were as follows :—

		Value.
Tanned unwrought	43,584 cwts.	£428,268
Boots and shoes	3,284,883 pairs.	950,794
Saddlery and harness	——	220,475
Wrought leather of other sorts	1,176,146 lbs.	258,541

The Australian colonies are the great purchasers of these goods.

VII.—HAIR AND BRISTLES.

Hair, the covering of mammiferous animals, consists of slender elongated horny filaments, secreted by a conical gland, or bulb, and a capsule, which is situated in the mesh work of the chorion, or true skin. Bristles, hedgehog spines, and porcupine quills, are all modifications of hair, having the same chemical composition, mode of formation, and general structure. Some kinds of hair are perennial, growing continuously by a persistent activity of the bulb and capsule, as human hair, and that of the mane and tail of

Hosted by Google

the horse; other kinds are annual, the coat being shed at certain seasons of the year, as the ordinary hair of the horse, cow, and deer. Hair, of all animal products, is one the least liable to spontaneous chemical change, and in its various forms, is valuable as material for numerous branches of industry.

HUMAN HAIR.—This is imported from Germany and France, and is furnished, the light coloured by the German and the dark coloured by the French girls, who look forward anxiously to the hair harvest for the means of purchasing trinkets and dresses. A head of hair weighs from eight to twelve ounces, and, according to its colour, is worth from thirty to sixty shillings per pound. In the spring, the Paris hair merchants send agents to all parts of France to purchase the beautiful tresses of the French girls, who cultivate an annual crop for sale with the same care as the farmer cultivates a field crop. About 200,000 lbs. are purchased in this way every spring, and made into perukes, false curls, &c. Human hair is also manufactured into a variety of articles of personal adornment known in commerce as hair-jewellery, such as bracelets, armlets, lockets, brooches, necklace-rings, watch-rings, which are not unfrequently worn in memory of the person to whom the hair belonged.

HORSEHAIR.—This is collected in the various towns of England from ostlers and others, and sent up to London in sacks. Besides that supplied by our own horses, we import annually from Russia and South America about 30,000 cwts. Horsehair is extensively used for military accoutrements, and as stuffing for mattresses; a cloth of great durability is manufactured from it, and employed in covering sofas, chair bottoms, and railway carriages. The first crinoline petticoats were made from horsehair, and hence the origin of the name (Latin, *crinis*, hair).

The hair of the elk, ox, goat, and camel is also extensively imported into this country, and used for various purposes. The hair pencils used by artists, and termed

Hosted by Google

camel's hair pencils, are composed of the fine hairs furnished by the sable, miniver, marten, badger, and polecat, as well as by the camel. They are usually mounted when small in quills, and when larger in tinned iron tubes. A good hair pencil is known by forming a fine point when moistened and drawn through the lips, all the hairs uniting in its formation.

The quantity of hair imported for the use of our manufacturers in 1864 was—

	Cwts.	Value.
Ox and elk	63,771	£311,109
Horse	17,743	90,511

BRISTLES are the stiff, glossy hairs growing on the backs of wild and domesticated swine. They are imported into this country from Germany, Russia, Denmark, and Poland, and used in the manufacture of brushes for the hair, clothing, teeth, and nails. Russia is the great mart for bristles, those of the Ukraine being most esteemed; France also sends us considerable quantities. Bristles are of various colours, black, grey, yellow, but the kind called the lily, on account of its silvery whiteness, is the most valued, and is used chiefly for shaving brushes, tooth brushes, and the softer descriptions of hair brushes. In 1864 our imports from Russia were 1,958,112 lbs., valued at £252,923—from Hamburg 207,274 lbs., valued at £26,772—and from Prussia, Belgium, France, and other parts of Europe 184,749 lbs., valued at £23,346, making a sum total of 2,346,135 lbs. valued at £303,041 in 1867. In 1867 the total import was 2,378,526 lbs.

THE PORCUPINE (*Hystrix cristata*, L.).—This animal is found throughout Southern Europe, and allied generic forms exist in North America. The porcupine quills sold in England are chiefly obtained from the European species, which is not common; therefore the quills are expensive. Work-piercers or eyeletteers for ladies, penholders, tooth, picks, fish-floats, and fancy work-boxes, are made from these quills.

Hosted by Google

VIII.—HORNS AND ALLIED SUBSTANCES.

1. Horns.

In zoology, all hard and more or less elongated processes projecting from the head are called horns. These natural weapons are either solid bone only, when they are called antlers, as in the stag, or they are composed of bone and horn, as in the sheep, goat, and ox. Horns of the latter kind consist of a hollow bony basis or core, on the surface of which is secreted a number of thin layers of true horny material. In the case of the giraffe, the horns consist of bone covered with hair, and are not deciduous. The horn of the rhinoceros is a mere appendage of the skin, and consists of horny fibres or hairs matted together. The antlers of the stag are shed annually, their fall being coincident with the shedding of the hair. True horns, or those which consist either partly or entirely of horny material, are never shed.

Chemically considered, horn may be regarded as intermediate in composition between albumen and gelatine, with a very small percentage of earthy matter. There is a graduated connection subsisting between the substance of horns, nails, claws, hoofs, feathers, scales, hair, and even skin. The animals that supply horn for our manufactures are principally oxen, bulls and cows, goats and sheep, their horns being preferred on account of superior whiteness and transparency.

The first process in horn manufacture consists in effecting a separation of the true horn from its bony basis. This is accomplished by macerating the horns in water, which causes putrefaction of the membrane lying between the core and the horny sheath, and renders the former easily separable from the latter. The horn then goes through the processes of scalding and roasting, which soften it, and render the laminæ capable of separation from each other. It is next slit with a strong pointed knife; and by the appli-

Hosted by Google

cation of a pair of pincers, one to each end of the slit, the cylinder or cone of horn is opened until it is nearly flat. These flats are then placed on their edges, vertically, in a strong iron trough, having between them plates of iron, half an inch thick and eight inches square, which have been previously heated and greased. These plates are now powerfully compressed by means of wedges driven in at the ends, the degree of pressure depending on the use to be made of the horn. For the leaves of lanterns, it must be sufficiently strong to break the grain or cause the laminæ of the horn to separate a little, so as to allow of the introduction of a round pointed knife between them, to complete the separation; for combs, a very slight degree of compression is enough, otherwise the breaking of the grain would cause the teeth of the comb to split at their points. The sheets of horn are next removed from the press and placed, one at a time, on a board covered with bull's hide, secured with a wedge, and scraped with a draw knife, having a wire edge turned by means of a steel rubber. When reduced to the proper thickness the horn plates are polished with a woollen rag dipped in charcoal powder, a little water being added from time to time; they are then rubbed with rottenstone, and finished with horn shavings.

When combs are ordered which are too large to be made from a single plate of horn, two or more plates may be united by the skilful application of pressure and of heat, sufficient to melt the horn; and, when well managed, the line of union cannot be detected. The Chinese are very skilful in this kind of work, as is evident from their large globular lanterns, some of which are four feet in diameter, and which are made of small united plates of coloured and painted horn. The painted toys known as Chinese sensitive leaves, which the heat of the hand or of a fire will cause to curl up as if alive, are made from the best of the thin films of horn scraped off the plate by the draw knife.

Horn is easily dyed, as can be seen in the above-named

Hosted by Google

lanterns of the Chinese. In this country it is usually coloured of a rich reddish-brown, and spotted to imitate tortoise-shell. This is effected by boiling together, for half an hour, a mixture of red-lead, pearlash, quicklime, and a little pounded dragon's-blood, and applying the mixture hot to the parts of the horn which it is intended to colour. For a deeper colour, a second application must be made; and for a blacker brown, the dragon's-blood is omitted.

Horn is manufactured into many other articles besides combs. Snuff-boxes, drinking-cups, shoe-horns, and powder-horns, are all made of horn. The fragments of horn, melted and compressed into a solid mass in moulds, form bell-pulls, handles for table knives and forks, knobs for drawers, and many other useful articles; or, if exposed to a decomposing heat in close vessels, these fragments develop Prussic acid, and for this reason are in demand among the manufacturers of Prussian blue, and of the beautiful yellow prussiate of potash. The solid tips of the horns are always sawn off, because these parts are not lamellated, and, therefore, incapable of separation into plates. They are made into knife and umbrella handles, the tops of whips, buttons, and various other articles.

The quantity of horn annually worked up in the manufactures of Great Britain, including the produce of our own animals, is estimated at 6,400 tons, of the value of £180,000. The comb manufacturers alone consume 1,300 tons, which produce £320,000 worth of combs. Horns of oxen are largely exported from South America, from Buenos Ayres, Monte Video, and Brazil, the last taking, as regards size and quality, the first rank. The Indian buffalo from Siam furnishes a very valuable horn, of which we receive annually about 26,000; the Cape of Good Hope and New South Wales also supply our markets with ox horns. The manufacture of articles from hoofs and horns is carried on very extensively at Aberdeen in Scotland, where an immense establishment exists.

Hosted by Google

The hoofs of horses and ruminant animals, though similar to horn in character, are not so useful as horns, because heavier and less easily worked. They are made available chiefly in the manufacture of buttons and cheap combs.

II. WHALEBONE.

WHALE (*Balæna mysticetus*).—This animal furnishes the baleen or whalebone of commerce. Commonly regarded as a fish, they are nevertheless true mammals, producing their young alive, and suckling them for a considerable time. They are very sociable, swimming in large shoals, and sporting on the surface of the water in their native arctic seas.

Whalebone or baleen consists of numerous parallel laminæ descending perpendicularly from the palate of the animal. The object of this structure is to form an efficient sieve or strainer for the food of the whale, as it comes in with the water. Although provided with an immense mouth, this enormous creature has an œsophagus or food-pipe so small that he is compelled to nourish his vast bulk by the consumption of some of the smallest inhabitants of the sea, his food consisting of small mollusca and crustacea. "To procure these insignificant morsels he engulfs a whole shoal of them at once in his capacious jaws, where they are of course entangled among the fibres of the baleen; the water is then strained off and expelled through the blow-holes, and the monster is thus enabled to pass his diminutive prey at his leisure into his stomach."*

The length of the largest pieces of baleen in a whale sixty feet long is about twelve feet, and the pieces are arranged in two rows, 300 in each. The average weight of each piece is seven pounds, and the weight of the whole is therefore 4,200 pounds, or upwards of one ton and three quarters, worth about £160 a ton.

Whalebone is prepared for use by immersion for twelve

* "Natural History of the Animal Kingdom." By W. S. Dallas, F.L.S. 1856.

Hosted by Google

hours in boiling water, which softens and renders it fit for manufacturing purposes. It is valued for its flexibility, tenacity, compactness, and lightness, and is cut into quadrangular sticks for the ribs of umbrellas and parasols, the supports of stays and other articles of ladies' wear. In thin strips whalebone is used for covering whip-handles, walking-sticks, and telescopes. These strips also are plaited like straw to form hats and bonnets, whilst the fine shavings are employed by the upholsterers as a stuffing for cushions, for filling fire grates in summer, and for other useful purposes

III. Osseous Substances.

Antlers.—The antlers of the different species of deer are very valuable for making a variety of useful and ornamental articles. The chief supply is furnished by the elk, wapiti, stag or red deer, and fallow deer. In Switzerland, brooches, pins, and bracelets are made from stag's horn; in Sheffield the whole shaft of the horn is used in making the handles of carving knives, or it is cut up into small plates and riveted on to an iron case for the handles of pocket and pen-knives. About 400 tons are annually imported from Hindostan and Ceylon for this purpose; another 100 tons come from Germany, Russia, Spain, and Italy, and from our own parks. About 18,000 head of deer are annually killed in Greenland, and their horns sent over to this country. The shavings of the horns are employed for the purpose of making ammonia, which has therefore long been popularly known as "hartshorn."

Ivory.—Our supplies of ivory are derived chiefly from the Asiatic and African elephants; the tusks or canine teeth of these animals furnish the article, but those of the African species are the most valuable. Elephants' tusks from two to ten feet in length, and weighing from 6 to 160 pounds, are imported into this country from Senegambia, Guinea, Mozambique, and Sofala; and also brought from the interior of Africa in caravans and shipped at Alexandria, Tunis,

Hosted by Google

Tripoli, and Cairo. We receive them, besides, from Bengal, Birmah, Siam, Cochin-China, Ceylon, Sumatra, and Java. There are large buildings erected in Birmingham for the manufacture of ivory, and also at Nuremberg in Germany. The Chinese are unrivalled in this manufacture. Their ivory balls, carved one inside another, are marvels of patience, industry, and ingenuity; and their chessmen, cabinets, drinking cups, and numerous other articles are most elaborate.

Generally and technically under the name of ivory are comprised the teeth of the narwhal (*Monodon monoceros*), walrus (*Trichecus rosmarus*), and hippopotamus (*Hippopotamus amphibius*), which, like ivory, are worked up into a variety of things, and always keep white.

Ivory is largely consumed in the manufacture of billiard balls, which cost from six to twelve shillings each, and are so nicely turned that they are perfectly spherical, and made to correspond accurately in size and weight, even to a single grain. The greatest consumption of ivory is undoubtedly in connection with the cutlery trade. A large amount is also worked up in the manufacture of the backs of hair and tooth brushes.

The miniature tablets, so invaluable to the artist, are cut from off the tusk by an extremely thin saw acting horizontally, just as we pare an apple, so that from a solid tusk, of the ordinary size, a sheet of very considerable length can be obtained. In the Great Exhibition of 1851 one manufacturer exhibited a sheet of ivory sixty feet in length, obtained without joining, and which had thus been pared off from a single tusk. We import annually 50,000 elephants' tusks, weighing 10,000 cwts., consequently not less than 25,000 elephants are killed annually to supply the English market alone.

The material of ivory is so valuable that economy in its use is necessarily studied, and the smallest fragments are preserved. The refuse of ivory is used for making the

Hosted by Google

finest black colour (*noir d'ivoire*) by converting it into charcoal in air-tight vessels. Such ivory refuse consisting of ivory scrapings, shavings, and saw-dust, when boiled, makes an excellent jelly, quite as good as calf's-foot jelly, and with the advantage that it suffers no change by keeping. Ivory refuse is therefore saleable to the confectioner and pastry-cook.

BONE.—The skeleton or framework of animal bodies consists of bones articulated with each other, which protect the vital organs, and form a basis or support for the softer parts, and for the attachment of the muscles or organs of locomotion. In the arts, bones are extensively employed by the cutler, comb and brush maker, chemist, confectioner, and agriculturalist. Common bone is manufactured into buttons, combs, knife, fork, and brush handles, card cases, parasol handles, book folders, and numerous other articles. The chemist obtains phosphorus, sal-ammoniac, and charcoal from bone, and the farmer a most valuable manure, super-phosphate of lime, which has a quick and efficient action on the crop. Large quantities of bones of oxen are imported to Great Britain from Buenos Ayres, &c., for this purpose ; and also the bones of seals captured in the North Seas for their fur and oil, and brought home by the sealers. The number of tons imported during 1867 was 83,814.

PRODUCTS OF THE CLASS AVES.

BIRDS are warm-blooded, vertebrated animals, characterised by a double circulation and respiration, the adaptation of their anterior extremities for flight, oviparous reproduction, and a covering of feathers. The following classification, founded on certain modifications in the structure of the beak and foot, is that which is generally adopted by naturalists.

1. *Raptores* (Latin, *raptor*, a robber), or birds of prey, having a strong, curved, sharp-pointed beak, short robust legs, and a foot furnished with three toes before, and

Hosted by Google

one behind, which are armed with long, strong, crooked, and more or less retractile talons, adapted to seize and lacerate a living prey. Examples: eagle, hawk, and vulture.

2. *Insessores* (Latin, *insideo*, I sit on), or perching birds, having three toes before and one behind, slender and flexible, with claws, long, pointed, and slightly curved; a foot, in fact, organised and adapted for the delicate operations of nest building, grasping the slender branches of trees, and perching on them. Examples: sparrow, robin, and crow.

3. *Scansores* (Latin, *scando*, I climb), or climbing birds, with the four toes arranged in pairs, two before, and two behind, a conformation of the foot most suitable for climbing trees. Examples: woodpecker, cuckoo, and parrot.

4. *Columbidæ* (Latin, *columba*, a pigeon), includes pigeons and doves.

5. *Rasores* (Latin, *rado*, I scratch), or scratching birds, having three toes before and one behind, strong, straight, and terminated by robust, obtuse claws, adapted for scratching up the soil. Examples: turkey, pheasant, partridge, and the common barn-door fowl.

6. *Cursores* (Latin, *curro*, I run), or running birds, with wings unfitted for flight, and feet formed for running swiftly over the ground, with two and sometimes three toes in front, and none behind, except in the apteryx. Examples: ostrich and cassowary.

7. *Grallatores* (Latin, *grallator*, a stalker), wading birds with long legs, the three anterior toes long and slender, and the posterior toe elevated and short; a form of foot and leg which enables the bird to seek its food in water along the margins of rivers, lakes, and seas. Examples: crane, heron, sandpiper.

8. *Natatores* (Latin, *natator*, a swimmer), swimming birds, including those which have the toes united by an intervening membrane. The body is protected by a dense covering of feathers, and a thick down next the skin; the

Hosted by Google

whole organisation is adapted for aquatic life. Examples: duck, swan, and goose.

The products of the class Aves consist of

I.—FOOD

All these orders of birds, with the exception of the first, afford flesh which may be eaten. The eggs of many of them are very nutritious, especially those of the Rasorial birds: 397,934,520 were imported from France in 1867. In one case, even the nest is available as food; namely, the Chinese edible birds' nests, constructed by a Javanese swallow. The collecting of these nests employs numbers of people, as they are largely exported to China from Java, Ceylon, and New Guinea. It is calculated that 30,000 tons of shipping are engaged in this traffic, and that the value of their freights is above £280,000. But the chief commercial value of birds lies in their

II.—FEATHERS.

A feather consists of three parts, the quill, the shaft, and the vane. The quill is that part of the feather by which it is attached to the skin; it is cylindrical, hollow, and semi-transparent, possessing in an eminent degree the qualities of lightness and strength. The shaft is covered by an outer layer of firm, horny material, like that which forms the quill, and encloses a soft elastic substance called the pith. The vane consists of barbs and barbules. The barbs are attached to the sides of the shaft, the barbules are given off from either side of the barb, and when long and loose, they characterise the form of feather known as a "plume," *e.g.*, that of the ostrich, which, commercially considered, is the most valuable of feathers. The development of feathers is always preceded by that of down, which constitutes the first covering of young birds. Their colours are due to peculiar organic pigments, which may be separated by appropriate solvents. The beautiful play of colours shown by some

Hosted by Google

feathers is referable to a decomposition of light, analagous to that produced by mother-of-pearl, and other striated surfaces.

The preparation of feathers for military decoration, or for the toilette, forms the art of the plumassier, the French term for the artisan who works on them. Feathers may be dyed a variety of beautiful colours, and of these, rose colour or pink is given by safflower and lemon juice, and deep red by a bath of Brazil wood boiling hot, after aluming; indigo supplies the blues of every shade, and turmeric the yellows, alum being the usual mordant.

Ornamental Feathers.—The most valuable and esteemed ornamental feathers, are, unquestionably those of

THE OSTRICH (*Struthio camelus*).—The elegance of these feathers arises from their slender stems and disunited barbs. Those taken from the living, or from recently killed birds are far more beautiful than the cast or dropped ones. The feathers from the back and above the wings are the best; next, those of the wings and tail. Ostrich feathers dyed black—for which purpose logwood, copperas, and acetate of iron are used—are sold to undertakers as mourning plumes; a full set is worth from £200 to £300. Ostrich feathers are scoured with soap, and then bleached. Fine white ones are worth from seven to eight guineas a pound. The finest white feathers of this bird, which is indigenous to northern and central Africa and Arabia, come from Aleppo in Syria. Good ostrich feathers are also received from Algiers, Tunis, Alexandria, and Cairo, and inferior ones from Senegal and the island of Madagascar.

THE LITTLE EGRET (*Herodias leuce*) is found in all the countries on the Mediterranean coast, and in Asia as far as the East Indies; an allied species, *H. ægretta*, is a native of tropical America. The feathers of both species are of the purest white, very delicately formed, six or eight inches in length, with slender shafts. The Turks and Persians embellish their turbans with them, and they form plumes for ladies' head-dresses in this country and on the continent.

Hosted by Google

THE GREAT WHITE HERON (*Ardea alba*) inhabits the shores of the Caspian, the Black Sea, and lakes of Tartary, and is also found in America and Africa. The largest and most expensive white heron feathers are furnished by the plumage of this bird.

COMMON HERON (*Ardea cinerea*).—The black heron feathers are supplied by this species, which is found throughout Europe, but especially in Prussia, Poland, and Russia. We receive the greatest quantity from Siberia.

ADJUTANT (*Leptoptilis Argála*), and a kindred species (*L. Marabou*), furnish the exquisitely fine and flowing plumes termed "Marabou feathers." The former species is the well-known scavenger bird of India, its name being derived from its habit of frequenting the parade-grounds; the latter is a native of Africa.

It is impossible to enumerate all the birds whose beautiful plumage supplies us with ornamental feathers. The feathers of the Bird of Paradise, the gold and silver pheasants, the peacock, of the several species of *Ibises*, the flamingo, the beautiful wing and tail feathers of the Argus pheasant, and the wing of the partridge and ptarmigan are all worn in children's and ladies' hats. Cocks' feathers furnish plumes for the French soldiers; eagles' feathers are worn in the hat and bonnet in Scotland, and a plume of them is a mark of distinction amongst the Zulus in South Africa. The wing and side feathers of the turkey supply trimmings for articles of ladies' apparel, and are made into victorines, boas, and muffs.

Artificial flowers made from feathers, are now much worn by ladies. The feathers selected for their manufacture are chiefly those of a purple, copper, or crimson colour, from the breasts and heads of humming-birds.

Feathers are also worn as articles of clothing.—The skin of the swan, after being properly prepared, is used for muffs, linings, and a variety of other articles of dress; the skin and feathers of the penguin, puffin, and grebe (*Podiceps*

Hosted by Google

cristatus) are worn as clothing on account of their beauty and warmth, supplying suitable material for victorines, tippets, boas, cuffs, and muffs, and other articles of winter attire. The native inhabitants of the arctic regions, in some parts, make themselves coats of bird-skins, which are worn with the feathers inside. Confucius, the Chinese philosopher, writes, that ere the art of wearing silk and hemp was understood, mankind used to clothe themselves with the skins of beasts and with feathers; and it is very certain that the Chinese are now very skilful and ingenious in the art of plumagery or feather working. They manufacture garlands, chaplets, frontals, tiaras, and crowns of very thin copper, on which purple and blue feathers are placed with much taste and skill.

Bed-feathers.

The lower barbs in feathers are usually loose, and form the down, which is called the "accessory plume." The quantity of this down varies in different species of birds, and even in the feathers taken from different portions of the body of the same bird. It is most abundant on aquatic birds, and as the value of bed-feathers depends on its amount, the feathers of ducks, swans, and geese—which have the "accessory plume" nearly as large as the feather—are the most esteemed.

The qualities sought for in bed-feathers — softness, elasticity, lightness, and warmth—are combined in common goose feathers; they are considered best when plucked from the living bird, and this cruel operation is repeated from three to five times in a year. Young birds are plucked as well as those of mature growth—the early plucking being supposed to favour the growth of the feathers. The less valuable kind of feathers, obtained from turkeys, ducks, and fowls, are also used for bed-stuffing, and are called "poultry feathers."

Eider Duck (*Anas mollissima*).—This bird furnishes

Hosted by Google

the softest, finest, and most valuable down-feathers that are in the market. Eider down is procured from the nest of this bird, which robs its own breast of feathers in order to make a warm home for its young. The Eider ducks build their nests in great numbers, in almost inaccessible rocky situations on the coasts of Ireland, Scotland, the Faroe Islands, Lapland, Nova Zembla, and Spitzbergen; and these nests are, at great risk of life, annually plundered of their down by the fowlers. Eider down comes to this country in the form of balls, about the size of a man's fist, and weighing three or four pounds. It is so fine and soft, that if one of these balls is spread and warmed over hot coals, it will expand and fill a bed big enough for two persons. Eider down is only used as a covering for beds, and never should be slept upon, as it thereby loses its elasticity.

In 1864 our imports of bed-feathers from Russia, Hamburg, France, and other parts of the Continent, amounted to 8,786 cwts., valued at £76,488; white ostrich feathers, 16,192 lbs., valued at £113,480; black ostrich feathers, 26,643 lbs., valued at £80,583; and feathers of all other kinds, 24,186 lbs., valued at £11,485.

Quill Pens.

The earliest pens, such as were used for writing on *papyrus* with a fluid ink, were made of reeds. Reed pens are still in use in Arabia, as they suit the Arabic character better than quill pens. These reeds are collected near the shores of the Persian Gulf, whence they are sent to various parts of the East. Quill pens are chiefly supplied by the goose, swan, and crow—the ostrich, turkey, and other birds occasionally contributing. Crow quills are usually employed in fine drawings, on account of the fine point to which they can be brought. Goose quills are employed for ordinary writing; but swan and turkey quills being larger, are preferable for copying.

Hosted by Google

Two principal sorts of quills are known in commerce—viz., Dutch quills, which are transparent and glass-like, and Hamburg quills, which are milk-white and clouded. Dutch quills are much esteemed; the Dutch were the first to find out the art of preparing quills for market, by removing the oil which impregnates them and prevents the ink from flowing freely along the pen. Quills are obtained in the greatest quantities from the countries along the Baltic; Hamburg is still the principal place for preparing and exporting them. Next to the Hamburg and Dutch quills, those of Riga are much liked, especially in England.

The manufacture of steel pens does not appear to have diminished the demand for quills. In 1855 we imported, independently of our home supply, 26,500,000 goose and swan quills. The quills used are the five outer feathers of the wing, which are classified according to the order in which they are fixed in the wing, the second and third being the best. With proper management, a goose may afford twenty quills during the year.

In the fens of Lincolnshire, geese are kept in large numbers. During the breeding season they are lodged around the owner's house. A gooseherd, it is said, can distinguish every goose in the flock by the tones of its voice.

PRODUCTS OF THE CLASS REPTILIA.

REPTILIA (Latin, *reptilia*, from *repto*, I creep).—Cold-blooded, vertebrated animals, having a heart so constructed as to transmit only a portion of the blood to the lungs. The blood is therefore imperfectly oxygenated, and there is a lower degree of animal heat. The amount of venous blood, however, transmitted to the general system varies in the different reptiles, and, in proportion as there is less or more of it, is there a corresponding difference in their temperature and vital activity.

As reptiles have no need of preserving a temperature

Hosted by Google

many degrees warmer than that of the medium in which they live, they are covered with scales, or hard bony plates, and without the warm clothing of the birds and mammalia.

The class Reptilia is divided into four orders, viz. :—

1. *Chelonia* (Greek, *chelone*, a tortoise), which are characterised by the enclosure of the body in a double shield or shell, out of which extend the head, tail, and four extremities. Examples : tortoise and turtle.

2. *Lacertilia*, or *Sauria* (lizards), having the body and tail elongated, the jaws furnished with teeth, the skin covered with scales, and the feet generally four in number. Examples : green lizard and blind worm.

3. *Crocodilia* include the alligators of America, the true crocodiles of Africa, and the gavials of Asia. Gigantic lizards, covered with closely-set bony plates.

4. *Ophidia* (Greek, *ophis*, a serpent), which are distinguished by the absence of the extremities, as in the snake.

The Chelonia are commercially the most valuable of the above orders, as we derive from them two important articles—turtle soup and tortoise-shell—the former the greatest luxury of the table, and the latter the most prized of horny materials.

GREEN TURTLE (*Chelonia mydas*).—This is one of the largest of the genus, often measuring five feet in length, and weighing between 500 and 600 lbs. It receives its name from the green colour of its fat. Its flesh is much esteemed, and in this country is regarded as a great luxury, large quantities being continually imported for the supply of the London taverns alone. Green turtles are found in the Atlantic ocean, where they are widely distributed. They are especially abundant near the Bahama Islands, and when they come ashore to deposit their eggs in holes in the sand are usually caught, either by harpooning or by turning them over on their backs, for when once turned they cannot get on their feet again. The Chinese catch them with the sucking-fish (*Remora*), which is put into the water with a

Hosted by Google

string tied to its tail. The remora darts at the turtle, to which it firmly adheres by means of its sucking apparatus, and both fish and turtle are then drawn into the boat.

Mr. Darwin thus describes the capture of this turtle at Keeling's Island: "The water is so clear and shallow that at first a turtle quickly dives out of sight; yet, in a canoe or boat under sail, the pursuers, after no very long chase, come up to it. A man standing ready in the bows at this moment dashes through the water upon the turtle's back; then, clinging with both hands by the shell of the neck, he is carried away till the animal becomes exhausted and is secured. It was quite an interesting chase to see the animals thus doubling about, and the men dashing into the water trying to seize their prey."

HAWK'S-BILL TURTLE (*Chelonia imbricata*).—The horn-like plates of this animal, and also of the carett, or giant tortoise (*Testudo caretta*), which lives in all the seas of the torrid zone, furnish the tortoise-shell of commerce. The Island of Ascension is a place of resort for these reptiles, and thousands of them are annually destroyed there. In most species of tortoise the scales which compose the carapace or upper covering adhere to each other by their edges, like inlaid work, but in the hawk's-bill turtle these scales are imbricated, or overlap one another, like the tiles on the roof of a house. The head is also smaller than in the other tortoises; but the neck is longer, and the beak narrower, sharper, and more curved, resembling a hawk's bill. The lamellæ or plates of the shell are semi-transparent, and variegated with whitish, yellowish, reddish, and dark brown clouds and undulations, so as to constitute, when properly prepared and polished, an elegant article for ornamental purposes. The shell of this animal is therefore largely imported into this country, as much as thirty tons' weight being annually consumed by the manufacturers. Tortoise-shell is used for the handles of pen-knives and razors, spectacle frames, card cases, ladies' side, back, and

Hosted by Google

dressing combs, and for inlaying work-boxes. The best tortoise-shell comes from the Indian Archipelago, where Singapore is the principal port for its exportation. It is also sent from the West Indies, from the Gallapagos Islands, situated on the west coast of South America, and from the Mauritius, Cape Verde, and Canary Islands.

"A large number of turtle eggs are secured every year for the sake of turtle oil. The eggs, when collected, are thrown into long troughs of water, and, being broken and stirred with shovels, they remain exposed to the sun till the yolk, the oily part, is collected on the surface, and removed and boiled over a quick fire. This animal oil, or 'turtle grease,' is limpid, inodorous, and scarcely yellow; and it is used not merely to burn in lamps, but in dressing victuals, to which it imparts no disagreeable taste. The total gathering from the shores between the junction of the Orinoco and Apure is 5,000 jars, and it takes about 5,000 eggs to furnish one jar of oil."*

PRODUCTS OF THE CLASS AMPHIBIA.

Rana esculenta (edible frog).—This species is eaten in France.

Rana pipiens (American bull-frog).—The hind limbs are considered a great luxury, and are exposed for sale in the markets of the United States.

Siredon pisciforme (the axolotl).—Inhabits the lake near the city of Mexico, where it is very abundant, attaining a length of from ten to fifteen inches. Thousands are sold, and esteemed a great delicacy by the Mexicans.

PRODUCTS OF THE CLASS PISCES.

VERTEBRATE animals inhabiting water, breathing by means of branchiæ or gills—vascular organs into which the circulating fluid enters, and which is submitted in a state of

* See Bates' "River Amazon."

Hosted by Google

minute subdivision in the vessels of the gills to the air contained in the water, and so oxygenated—swimming by means of flattened expanded organs called fins, the entire body being mostly covered with cartilaginous scales. The specific gravity of fishes is nearly the same as that of the watery element in which they live. Most of them have a membranous bag at the lower side of the spinal column, known as the "air bladder," which is so organised that the fish can vary its specific gravity by contracting or expanding the bladder, expelling the air or taking it in, and so sink or rise in the water at pleasure. It is somewhat remarkable that this air-bladder is quite rudimentary or altogether absent in fishes which live much at the bottom of the water, seldom or never coming to the surface, such as plaice, turbot, and sole. Progression in any direction is effected by the movements of the tail. The craving for food seems to be that which gives the chief impulse to their movements. Their rapacity has no bounds whatever; even when taken out of the water, and just expiring, they will greedily swallow the very bait which lured them to destruction.

The class of fishes has been sub-divided by Cuvier into two sub-classes.

1. *Pisces ossei*, or bony fishes, comprising those which have a true bony skeleton. Examples: herrings, salmon, and cod.

2. *Pisces cartilaginei*, or cartilaginous fishes, including those in which the skeleton never passes beyond its primitive condition of gristle or cartilage. Examples: the sturgeon, ray, and shark.

The first sub-class of osseous fishes are arranged according to the character of their organs of locomotion into:—

Acanthopterygii (Greek *akantha*, a spine, and *pterugion*, a fin), or spiny-finned fishes. Examples: perch, mackerel, and mullet.

Malacopterygii (Greek *malakos*, soft, and *pterugion*, a fin), or soft-finned fishes. Examples: herring, salmon, carp, and trout.

Hosted by Google

Fish constitutes an important article of commerce, furnishing us with immense quantities of oil and an abundance of food. Great Britain possesses a coast-line of 3,000 miles in extent, while that of Ireland is above 1,000 miles, and the greater part of the shores of both islands abound in those species of fish which exist in the largest numbers and yield the most acceptable and nutritious food. Hence a hardy and adventurous race of fishermen have arisen, well supplied with vessels beautifully built, and with materials of the best description. We shall notice only the fisheries commercially most valuable.

HERRING (*Clupea harengus*).—This fish appears in vast shoals upon our coasts from July to November, when it forsakes the deeper portions of the sea where it habitually dwells and comes into the shallow shore water for the purpose of spawning. These shoals, animated by a common impulse, are so enormous, that the sea for miles round shines with a silvery lustre from their glittering scales. It is certainly a wise and beneficent law which thus impels certain fish to approach the shore to deposit their ova; for whilst the best means are being taken for the continuance of the species, there is brought within the reach of man an abundant supply of nutritious food, which would otherwise be lost in the depths of the ocean.

The British herring fisheries are principally carried on off Galway, Mayo, in the estuary of the Shannon, at Banbury, and Waterford in Ireland; at Cardigan Bay and Swansea in Wales; at Yarmouth, Lowestoft, Hastings, and Folkestone in England; and on the coasts of Caithness, Sutherland, Ross, Aberdeen, Banff, Moray, and Berwickshire, in Scotland. In the harbour of the small town of Wick, in Caithness, as many as 2,000 boats, each having five or six men, have been congregated at one time during the herring season. Some idea of the extent of this fishery may be inferred from the fact that independently of the home consumption of fresh herrings in 1858, 636,122 barrels of herrings were cured, and 350,204

Hosted by Google

were exported, valued at upwards of £350,000. In Norway about 600,000 tons of these fish are annually taken and salted. Sweden, Denmark, Holland, and France are also largely engaged in this business.

The PILCHARD (*Clupea pilchardus*) closely resembles the herring. This fish is very abundant on the coasts of Cornwall during the spawning season in July. Like the herring it is taken with the net at night. The average annual produce of the Cornish pilchard fisheries is estimated at 21,000 hogsheads, each usually containing 2,500 fish, thus making the total number captured 52,500,000. About 10,521 persons, young and old, are employed, and the capital invested in boats, nets, and cellars for curing, is estimated at £441,215.

The SPRAT (*Clupea sprattus*), although smaller than the herring, is also very abundant, and furnishes an acceptable supply of cheap and agreeable food. It is caught during the winter months on the coasts of Kent, Essex, and Suffolk, and in such vast quantities as to give rise to the Stow Boat fisheries round the Thames estuary, where they are taken for manure, many thousand tons being sold to the farmers at from 6d. to 8d. per bushel for this purpose. Forty bushels of sprats serve for an acre of land.

WHITEBAIT (*C. sprattus*, juv.).—Every one familiar with an English newspaper has heard of the whitebait dinner, or fish dinner, at which whitebait is the chief dish—annually held at Greenwich by the members of the British Cabinet and the Lord Mayor and Aldermen of London. This little fish, so much prized for its delicious flavour, was formerly regarded as the fry of the shad, while other naturalists maintain that it is quite a distinct species. Günther, an authority of high repute, has recently shown that whitebait is the fry of the sprat. It has never been found with matured ova, and therefore does not ascend rivers for the purpose of spawning.

SARDINE (*Clupea sardina*) and ANCHOVY (*Engraulis encrasicolus*), both closely allied to the herring, replace that fish

Hosted by Google

in the Mediterranean. The former is taken in great abundance off the shores of Sardinia and Brittany, and packed in small metallic boxes, and is much esteemed as a breakfast relish. The latter, a small silvery fish four or five inches in length, is found on the coasts of France and Portugal. The head and entrails having been removed, it is salted and packed in barrels, and forms the well-known condiment, anchovy sauce. About 140,000 pounds are annually imported.

MACKEREL (*Scomber scombrus*).—This well-known and beautiful fish, so valuable as an article of food, is found in abundance on the south and south-east shores of England. Out of the water it soon dies, and becomes quickly tainted. Those caught in the months of May and June are preferred. "Mackerel will bite at almost any bait, hence quantities are taken by hook and line. A slice cut from the side of a mackerel near the tail is a successful lure, or even a strip of red leather or scarlet cloth."* In 1823, 142 lasts of mackerel were taken at Yarmouth—a last is 10,000. This makes 1,420,000 individual mackerel.

SALMON (*Salmo salar*).—This is a soft-finned fish, the body being adorned with spots, and brilliantly coloured, and covered with cycloid scales. The species pass by almost insensible gradations into the clupeoid or herring family. Like the herrings they inhabit the sea, and not only approach the land, but ascend the rivers nearly to their sources in order to deposit spawn. For this object the salmon reaches the small streams near the sources of rivers, displaying an amount of perseverance and activity in getting there which is astonishing. Cataracts and weirs ten and twelve feet in height are cleared at a single leap, and should the fish be foiled the first time it tries again and again until successful. After spawning salmon are unfit for food. They descend the rivers with the floods, with which winter usually closes, to the sea, where they soon recover their condition, and return ample in size and rich in human nourishment, ex-

* *See* article *Fisheries*, "Encyclopædia Britannica," Eighth Edition.

Hosted by Google

posing themselves in narrow streams as if nature intended them as a special boon to man. Such salmon as are taken in estuaries or rivers are of course the property of those to whom the estuaries and rivers belong; but latterly, considerable quantities have been caught in bays and in the open sea, where the fishing is free. The London markets are principally supplied with salmon sent up from the Tweed, Tay, Don, and Dee, and from Norway, preserved fresh by being packed in ice The fishing is usually carried on in summer, and when the take is greater than can be conveniently sent off fresh, the residue are salted, pickled, or dried for winter consumption at home, or for foreign markets. Of late years there has been a decrease of salmon in the English and Scotch rivers, the result of poaching and overfishing. Legislation has done something to remedy the evil. Pecuniary penalties are inflicted on poachers and trespassers; and in Scotland the rivers are shut up—on the Tweed from October 15th to February 15th, and north of the Tweed from September 14th to February 1st.

Cod (*Morrhua vulgaris*).—This valuable fish is spread throughout the seas of Europe from Iceland to Gibraltar, and abounds on the eastern coast of North America from 40° to 66° N. lat., particularly around Newfoundland. It spawns in British waters about February, and is in the best condition as food from the end of October to Christmas. It is amazingly prolific, 9,384,000 ova or eggs having been counted by Leuwenhoeck in the roe of one female. As the cod frequents deep water it can only be taken by long deep sea lines, hooks being fastened at regular distances along their entire length. It is usual to fish for cod in water from twenty-five to forty fathoms in depth. Cod is voracious, and easily taken with a variety of baits.

The British cod fishery is carried on in a number of places contiguous to the shores of our islands. The most productive home fisheries are those off the coasts of Norfolk, Suffolk, Essex, Lincolnshire, and the Orkney, Shetland, and

Hosted by Google

other islands. The London market is supplied chiefly from the Norfolk and Lincolnshire fisheries. Fresh cod are usually kept alive in welled smacks, and are in this manner brought in good condition from the most distant points of our coasts. The well is capable of holding about fifty score, and receives its water directly from the sea, through perforations in the bottom of the vessel. These vessels are either anchored in a tide-way, or one of the sails is kept set, so as to produce a constant heaving motion, and, in consequence, a perpetual change in the waters of the well. The smacks never go farther up the Thames than Gravesend, as the fresh water intermingles with the salt above that point, and proves destructive to the fish.

It is, however, the quantity of cod and its allied kinds, haddock (*Morrhua æglefinus*), tusk (*Brosmus vulgaris*), and ling (*Lotus mola*), which gives to these fish their chief mercantile importance. In 1854, 3,523,269 individual fish of the cod and ling kind were caught, of which 1,385,699 were from the Orkney and Shetland Islands, and the remainder from the other fishing stations on our coasts. In 1857 the total amount of cod, ling, and haddock taken by the fishermen of the United Kingdom was:—Cured and dried, 104,668½ cwts.; cured in pickle, 4,393½ barrels; cured, dried, and exported, 34,310 cwts.

The greatest cod fishery in the world is on the banks of Newfoundland. These banks are based on a large rocky shoal about 600 miles in length and 200 in breadth, being, in fact, the top of a vast submarine plateau, over which the ocean rolls. This place is a great rendezvous for cod, which resort there to feed on the worms, which are plentiful in these sandy bottoms, and on account of its vicinity to the polar seas, whither they return to spawn. The cod are found here in such numbers that although maritime nations have for centuries worked indefatigably at these fisheries, not the slightest perceptible diminution of their abundance has ever been noticed. The Newfoundland cod fisheries are carried on now

Hosted by Google

principally by the French and Americans. The British interest in them has declined of late years very considerably, as we have transferred the site of our operations to the coast of Labrador, where 20,000 English sailors, with from 200 to 300 schooners, are annually employed. The Americans fit out their vessels chiefly at Boston, and thus from their vicinity to these fishing grounds possess a great advantage over the English. Immense quantities of cod are sent by England, France, and Holland, partly salted and dried, to Southern Europe, chiefly for consumption during Lent and the other fasts of the Roman Catholic Church.

TURBOT (*Rhombus maximus*).—Taken on all our coasts. The English markets, however, are supplied chiefly with Dutch turbot, which is preferred; these are caught on the sand banks lying between Holland and the eastern coast of England. The Dutch receive £80,000 per annum for supplying the London markets with turbot; and the Norwegians £15,000 for about 1,000,000 Norwegian lobsters, used partly turbot sauce.

SOLE (*Solea vulgaris*).—The sole is common on the British coasts, and in season from May to November. The principal fishing stations are on the south coast, from Sussex to Devonshire, especially at Brixham and Torbay. *Plaice*, *flounders*, *dabs*, *halibuts*, &c., are all in great request in the market, but can only be mentioned.

LAMPREY (*Petromyzon marinus*).—An eel-like cartilaginous fish, having a funnel-shaped mouth, surrounded by a circular suctorial lip, by means of which it adheres to stones (Greek, *petron*, a rock; and *muzo*, I suck) and to the bodies of those fish on which it feeds. Formerly the lamprey was considered a great delicacy, and one of our kings (Henry I.) is said to have died in consequence of eating too freely of it. Although not so much in demand now, great numbers are still furnished from the North Sea, the Baltic, and the German rivers, where they abound. Lampreys reach this country packed in jars with vinegar, spices, and bay leaves.

Hosted by Google

COMMON STURGEON (*Acipenser sturio*) belongs to the group of cartilaginous fishes. The body is elongated, spindle-form, and usually from five to six feet in length; the head, which is depressed and produced into a triangular snout, is covered with rows of large tubercular bony plates. The sturgeon is abundant in the seas of northern Europe, also in the Caspian, the Black Sea, and the Mediterranean, ascending the rivers in great numbers to spawn.

Caviare, which forms an important article of commerce, consists of the roe of different species of this fish, cleaned, washed with vinegar, salted, dried, and then pressed into small cakes, or packed in kegs. Russian caviare, from the Black and Caspian Seas, is considered the best. Much caviare is also prepared on the shores of the Lower Danube. That furnished by the Sterlet (*Acipenser ruthenus*) is so superior that, according to Cuvier, it is reserved for the imperial court of Russia.

Isinglass, another product from these fish, is prepared from their air bladders. This substance owes its commercial value to its extremely delicate fibres, which operate mechanically in the clarification of white wines and malt liquors. It is also much employed in cookery. Russian isinglass is preferred to that from Hungary and Germany.

PRODUCTS OF THE SUB-KINGDOM MOLLUSCA.

MOLLUSCA (Latin, *mollis*, soft).—Soft-bodied, invertebrated animals, devoid of an internal bony skeleton, having a gangliated nervous system, the ganglia, or knots of nervous matter, being irregularly dispersed in different parts of the body. They have a distinct pulmonary or branchial circulation, white or bluish blood, and, in most cases, a shell covering, in which the animal resides. This is secreted by the margin of a peculiar organ termed the mantle, or an external fold of the skin reflected over the body. Many of the lowest and some of the highest of the mollusca are

Hosted by Google

naked, or a horny and testaceous rudiment of a shell is developed, but remains concealed beneath the substance of the mantle. When, however, the shell is so much enlarged that the contracted animal finds shelter within or beneath it, then the mollusc is termed testaceous (Latin, *testa*, a shell). We shall confine our notes to the testaceous mollusca, as commercially, they are the most valuable. The following are the chief classes of the mollusca :—

1. *Cephalopoda*, or *head-footed* (Greek, *kephale* and *pous*, a foot), having the head well developed, protruding from the mantle, and furnished with tentacula, serving for the seizure of food and for crawling. Examples : nautilus and cuttle-fish.

2. *Gasteropoda*, or *belly-footed* (Greek, *gaster*, the belly, &c.), crawling by means of a broad muscular disc on the lower surface of the body, which serves as a substitute for legs. Examples : *Helix hortensis*, the garden snail ; *Lymnœa stagnalis*, the pond snail ; and *Limax agrestis*, the field slug.

3. *Pteropoda*, or *wing-footed* (Greek, *pteron*, a wing, &c.), comprehending a few molluscs which have a natatory wing-like expansion on each side of the head. They are naked, or provided with a delicate univalved shell. Example : *Clio borealis*.

Most of the species of the class *Pteropoda* are fossil, but a great many are still found in existing seas, living near the surface.

The *Clio borealis* forms the food of the whalebone whale. It is an inch long, uses its light shell as a boat, its wing-like fins as oars, and so navigates, in countless numbers, the tranquil surface of the arctic seas.

4. *Conchifera*, or *shell-carriers* (Latin, *concha*, a shell, and *fero*, I carry), including all the bivalved molluscs not *Brachiopods*. Examples : oyster, mussel, and pearl oyster.

5. *Brachiopoda*, or *arm-footed* (Greek, *brachion*, an arm, &c.).—Bivalves devoid of locomotive power, and attaching themselves to foreign bodies : they are furnished with two

Hosted by Google

long ciliated arms developed from the sides of the mouth, which, by producing currents, bring food to the animal. Examples: *Terebratula* and *Lingula.*

I.—DYES.

Some of the mollusca furnish dyes and pigments. The *Murex* yields various shades of purple and crimson. The celebrated Tyrian purple was formerly obtained from *Murex trunculus.* The cuttle fish (*Sepia officinalis*) which clouds the water by ejecting from its ink-bag a deep black fluid, thus effectually concealing itself, supplies the well-known pigment, *sepia,* of a deep brown-black colour; and a calcareous spongy plate, found in the same fish, is used as a substitute for emery or sand paper, and as a dentifrice.

II.—SHELLS.

The beautiful variety of form and colour in shells has in all ages attracted notice. Among savages shells are used for personal adornment, and made into domestic utensils, such as knives, spoons, drinking-cups, fish-hooks, and even razors. The wampum belts of some of the North American tribes are made of shells. A small species of white glossy shell, called cowry (*Cyprœa moneta*), abundant in the Asiatic and African shores, is used as money in small payments in India and throughout extensive districts in Africa, 100 being equivalent to one penny. The same cowries are converted into a glaze for earthenware and an enamel for clock faces. The thin inner layers of a large flat bivalve (*Placuna placenta*) found in the Chinese sea, remarkable for their transparency and the absence of the nacreous or pearly layer within, are used by the Chinese for windows instead of glass. In Roman Catholic countries clam shells form receptacles for holy water; while some, perfectly white, are cut up for arm-rings and other ornaments. The *Turbinella,* or chank shell of India, fished up by divers in the Gulf of Manaar, on the north-west coast of Ceylon, is exported to

Hosted by Google

India, where it is sawn into rings of various sizes, and worn on the arms, legs, fingers, and toes, by the Hindoos. The demand for these shells is caused by the religious rites of the Hindoos, and some choice specimens of them are valued at their weight in gold. The helmet shell (*Cassis*) supplies pieces large enough for umbrella handles, and the nacreous or inner layers of this shell, and other species, are exquisitely sculptured by Italian artists in imitation of antique cameos, and employed for rings, brooches, pins, bracelets, and other ornaments.

The *byssus*, or fasciculus of shining semi-transparent horny or silky filaments, by which many kinds of bivalves attach themselves to rocks, is in the large *Pinna* or wing-shell, so much developed that, by the natives of Sicily it is manufactured into gloves, socks, caps, &c., of a beautiful brownish colour. These are valuable as objects of curiosity, but too expensive for general use, the price of a pair of gloves being six shillings, and that of a pair of stockings eleven shillings.

The large proportion of lime in shells renders them useful in making cement, and valuable as a fertiliser of the soil; hence shell-sand, the product of their natural crumbling on sea shores, is employed with advantage in improving heavy loams and clayey or peaty soils. Mixed with any soil deficient in lime, shell-sand exercises a beneficial influence.

If we look at shell we shall find it to consist of three layers, viz., one external and rough, a medium layer consisting of delicate super-imposed laminæ of polygonal prisms, and an internal and shining one called the nacre, which is composed of a series of extremely delicate deposits, unequal in size and extent, and therefore imbricated in their position on each other, their margins presenting a series of lines with waved edges. These wrinkles, or furrows, which are of microscopic proximity and minuteness, decompose the rays of light, and produce that beautiful iridescent

Hosted by Google

play of colours visible on the surface of the shell. It is this nacreous lustre which renders shells so capable of being applied to ornamental purposes, and gives to them their principal commercial importance.

The brilliancy of the colours reflected depends on the thinness of the laminæ of the nacre. Where the laminæ are thick, a dull white appearance only is visible, as in the oyster. Sometimes the external layers covering the nacre are rubbed off by natural causes, as in the case of shells which have been subjected to the roll of the waves on the sea-shore, where quantities may be found having the bright and iridescent nacreous surface exposed, but more or less injured; generally, however, these outer layers are removed artificially with a knife, and the shell is polished. This nacreous layer is the well-known mother-of-pearl, and shells having it in the greatest abundance are called pearl shells, such as the sea-ears (*Haliotis*) and a large species of top-shell (*Turbo marmoratus*, L.). Mother-of-pearl, in consequence of its lamellar structure, admits of being split into laminæ; or it is cut, without being slit, into square, angular, or circular pieces, which are employed extensively in the arts, particularly in inlaid work and in the manufacture of knife and razor-handles, buttons, snuff-boxes, and toys. Cut into the form of leaves, flowers, and other devices, it forms a favourite material for ornamenting *papier-maché*—a name given to articles manufactured from paper pulp, which is moulded into varied forms, and rendered as hard as wood by being dried in an oven.

The most valuable shells in commerce are, however, those which form the nacre into the fine, compact, concentric layers called pearls. These pearls are sometimes found free within the lobes of the mantle, but most frequently adhere to the nacreous coat of the shell. The species which produces the largest and most valuable pearls is the

PEARL OYSTER (*Meleagrina margaritifera*, L.).—The

Hosted by Google

most valuable pearl fisheries are those on the western coast of Ceylon; at the Bahrein Islands in the Gulf of Persia; at Tuticoreen, on the coast of Coromandel; off St. Margarita, or Pearl Islands, in the West Indies; in some places on the coast of Columbia; and in the Bay of Panamá in the Pacific. Very large and beautiful pearls, too, are said to have been found recently on the peninsula of California. The fisheries in the Persian Gulf are the most valuable, giving employment to 4,000 boats and about 30,000 people, and yielding a revenue of more than 2,500,000 thalers (£375,000).

The value of pearls depends upon their size, purity, and lustre. The best are spherical, free from spot or stain, and have a clear, bright, white or yellowish-white, or bluish colour, with a peculiar lustre or iridescence. They vary in size—some not bigger than small shot, and others as large as a pea or bean. When pearls dwindle to the size of small shot, they are called seed-pearls, and are then of little value. "A handsome necklace of Ceylon pearls, as large as peas, is worth from £170 to £300; and one of pearls the size of peppercorns may be had for £15."* The largest and most valuable pearl of which we have any authentic account was purchased by Tavernier, at Catifa, in Arabia—a fishery famous in the days of Pliny—for the enormous sum of £10,000. It was pear-shaped, two inches in length, and half an inch in diameter, and is now the property of the Shah of Persia. The finest pearls generally pass under the name of "oriental pearls;" and those with less lustre and beauty, even if they do come from the East Indies, are called "occidental pearls."

Pearls are most abundant in the pearl oyster, which appears to be subject to a disease, caused by the introduction of foreign bodies within the shell. A pearl, if cut through, will generally show a nucleus, formed by a grain

* See *Pearls*, "Dictionary of Commerce." By J. R. McCulloch. Also Journal of the Society of Arts, No. 896, vol. xviii.

Hosted by Google

of sand or some other foreign body, around which the nacreous matter has accumulated in concentric deposits, instead of being spread in the usually horizontal laminæ on the inside of the shell. The Chinese are acquainted with this fact, and are in the habit of producing pearly deposits artificially, on the images of Buddha and other objects, by placing them within mussels (*Unio plicatus*), which are then thrown back into the river, and after a while re-captured, and the image removed, which has thus become coated with pearl. In the British and South Kensington Museums examples may be seen of images and other objects which have obtained their pearly coating in this way.

The value of pearls has been greatly depreciated in modern times through the successful imitation of them. The spurious glass and wax pearls now made in Paris, Venice, Nuremberg, and Bohemia, have much diminished the trade in real pearls. The best imitations were first made by a French bead-maker named Jacquin. The water in which the fish called the bleak (*Cyprinus alburnus*) is washed, is filled with powdery particles, which shine with a pearly lustre. Jacquin noticed this; he called this powder "essence of pearl," or "*essence d'orient*," and succeeded in covering the inside of glass beads with it, thus producing a most admirable spurious glass pearl. A considerable trade is done with spurious pearls on the coasts of Senegambia, Guinea, and Congo, and the adjacent islands, where they are indispensable goods for the transaction of business with the natives.

III.—EDIBLE SPECIES.

This notice of the mollusca would be incomplete without some reference to their value as a source of human food. Amongst the edible kinds we have the

OYSTER (*Ostrea edulis*).—Vast beds of this mollusc are planted and tended with great care. The oyster culture is carried on most extensively at Colchester and other places in England, and on the coasts of France. The oysters are

Hosted by Google

laid in beds, in creeks near the shore, where in two or three years they grow to a considerable size, and improve in flavour. Between 14,000 and 15,000 bushels of Essex oysters are consumed in London annually. There are 200 vessels, of from twelve to fifty tons burden, manned by 400 or 500 men and boys, continually dredging for oysters on the Essex coast.

MUSSEL (*Mytilus edulis*).—This is another popular mollusc, not so digestible as the oyster, but nevertheless in considerable demand as human food, and largely employed as bait for whiting, haddocks, and cod. We have also the COCKLE (*Cardium edule*), PERIWINKLE (*Littorina littorea*), WHELK (*Buccinum undatum*), and the ORMOND WHELK (*Fusus antiquus*), with which our markets are abundantly supplied. Others might be mentioned, but enough has been said to show that, whilst the shell of the mollusc is attractive and useful, the soft body of the creature that dwells within it is not less valuable.

PRODUCTS OF THE SUB-KINGDOM ANNULOSA.

Annulosa (Latin, *annulus*, a ring), a name given to the third great division of the animal kingdom. The body, in *Annulosa* generally, presents a symmetrical form, and consists of a series of rings or segments; the nervous system is a double nervous thread, which extends along the body at its lower side, and is united at certain distances by double "ganglia," as these nervous masses are termed—nerves being given off from these ganglionic masses. In the group *Annuloida*, the body is ringed and devoid of limbs, whilst in the *Articulata* it is composed of movable pieces, and the limbs are jointed.

The following are the chief classes of the Annulosa:—

1. *Annelida* (Latin, *annullus*, a little ring), animals having bodies soft and pliable, more or less cylindrical, and formed of a great number of small rings. Examples: earthworm and leech.

Hosted by Google

2. *Crustacea* (Latin, *crusta*, a hard covering), having an articulated, hard shelly case or covering, in which the softer parts of the body are contained. Examples: crabs, lobsters, &c.

3. *Arachnida* (Greek, *arachne*, a spider), having the head and thorax confluent with each other, and the body consequently consisting of only two segments, with eight legs, and smooth eyes. Examples: spider and scorpion.

4. *Insecta* (Latin, *in*, into, and *seco*, I cut), including those animals having an insected or divided appearance of the body into three well-marked portions, called respectively the head, thorax, and abdomen. Six legs are articulated with the thorax. Examples: bee, moth, and beetle.

In the first class, *Annelida*, we have one species of very considerable value in commerce, the

LEECH (*Hirudo medicinalis*, L).—This is an abranchiate red-blooded worm, provided with a circular disc or sucker, at either extremity of the body. The oval aperture or mouth, is formed of three pairs of cartilaginous jaws, each armed with two rows of very fine teeth, and disposed in such a manner that they form three radii of a circle. This apparatus enables the leech so to penetrate the skin as to ensure a ready flow of blood without causing a dangerous wound. Leeches are usually found in pools and marshes, sometimes in England, but principally on the Continent, especially in Portugal, the south of France, Germany, Hungary, and Russia. The greatest quantities come through Pesth and Vienna, from Hungary. Most of the leeches used in England are imported from Hamburg, whither they are sent from the lakes of Pomerania and Brandenburg, and from the province of Posen in Prussia.

Leeches are taken by men, who wade into the pools with naked legs, to which they fasten themselves. The men then leave the water, and remove them before their bites become injurious. Leeches are sent over in bags, or more frequently in small tubs, closed with stout canvas to allow

Hosted by Google

a free passage of air. Each tub usually contains about 2,000 leeches. Some idea of the extensiveness of the leech trade may be obtained from a fact mentioned by Dr. Pereira, that some years ago, "four principal leech dealers in London imported on the average 600,000 leeches monthly, or 7,200,000 annually." The annual consumption of leeches in Paris is estimated at 3,000,000, and that of the whole of France at 100,000,000.

The second class, *Crustacea*, furnishes several species which are used as food—as crabs, lobsters, crayfish, prawns, and shrimps, so well known as to render description needless. Omitting the Arachnida, which are of no commercial value, we come to

The fourth class, *Insecta*, which is pre-eminent over the others in the number of individuals, and in their beautiful forms, colours, and transformations. Its members are in the highest degree valuable to man, furnishing him with unlimited supplies of honey, wax, silk, and dyeing materials. The following are the most important insects, regarded from a commercial point of view.

The SILKWORM MOTH (*Bombyx mori*) belongs to the family *Bombycidæ*, a section of the nocturnal lepidoptera or moths. It has short plumose antennæ, a thick short body, stout legs, and white wings, with two or three dark lines stretching across them parallel to the margin. It lays its eggs, which are of a greyish tint, on the leaves of the mulberry tree (*Morus alba*) upon which the larva feeds. These larvæ form the cocoons from which the silk is procured. The eggs may be preserved a long time without deteriorating, provided they are kept free from damp, and not too many in the same packet. The eggs in this state are called by the silk cultivators seed.

The larvæ when first hatched are a quarter of an inch long and of a dark colour, and the first care after their birth is to separate them from their shells, and place them in hurdles where they may find appropriate food. For this

Hosted by Google

purpose, a paper perforated with holes and covered with mulberry-leaves is spread over the basket in which the larvæ are placed, and in passing through the holes to get at the mulberry leaves, they free themselves from their shells. The silkworm lives in the larval state from six to eight weeks, during which time it moults or changes its skin four times, increasing in size and voracity with every moult, and when fully grown is about three inches in length.

The caterpillar now stops eating, betakes itself to some convenient spot where, after spinning a few threads in various directions, it suspends itself in the midst of them, and by continually twisting its body, it gradually envelopes itself in a thick, silken, oval-shaped cocoon. The silk is a secretion of a pair of tubes called *sericteria*, which terminate in a prominent pore or spinneret on the under lip of the caterpillar. The two fine filaments from the *sericteria* are glued together by another secretion from a small gland, so that the apparently single silken thread proceeding from the caterpillar, which forms the cocoon, is in reality double. Whilst spinning the cocoon, which is usually completed in five days, the larva decreases in bulk, casts its skin, becomes torpid, and ultimately assumes the chrysalis form in the interior of the cocoon.

The cocoons, when completed, are thrown into warm water, which dissolves the glutinous matter that causes the threads to adhere, and separates them. The end of the thread is then found, and placed upon a reel; the silk is wound off the cocoon, and formed into what are called hanks. When this is carefully done, the silken thread obtained from a single cocoon is sometimes from 750 to 1,150 feet long, or of an average length of 300 yards. Twelve lbs. of cocoons yield 1 lb. of raw silk. About one ounce of silkworms' eggs will produce 100 lbs. of cocoons; 16 lbs. of mulberry leaves are food sufficient for the production of 1 lb. of cocoons; and each mulberry tree yields about 100 lbs. of leaves. These data afford the reader the means of cal-

Hosted by Google

culating the number of insects, eggs, trees, and leaves, necessary for the production of 6,000,000 or 8,000,000 lbs. of silk, the quantity that is annually consumed in the United Kingdom.

The art of rearing silkworms, of unravelling the threads spun by them, and manufacturing those threads into articles of dress and ornament, seems to have been first practised by the Chinese. In China, Japan, and India, silk has formed, from time immemorial, one of the chief objects of cultivation and manufacture. The silkworm moth and the mulberry tree are, in fact, both natives of China, and a great portion of our supplies of silk are still derived from that country. There was a time when silk, now so abundant, was valued in Rome at its weight in gold, and the Emperor Aurelian refused his empress a robe of it on account of its dearness. At the period when our ancestors were naked savages—2,000 years ago—the Chinese peasantry, amounting in some provinces to millions in number, were clothed in silk.

From China, the cultivation of silk extended to Hindostan, and thence to Europe, in the reign of the Roman emperor Justinian, about the middle of the 6th century. From the 6th to the 12th centuries the culture of silk was confined to Greece, particularly to the Peloponnesus, where it spread so much that this part of Greece derived its modern name Morea (Latin, *morus*, a mulberry) from that circumstance. From Greece, silk cultivation spread into Sicily, Italy, Spain, and finally France. The French commenced its culture in 1564, under the auspices of Henry IV., and the raising of raw silk and its manufacture now forms a very considerable proportion of the French trade. We have not space for further detail of the progress of the silk manufacture.

At present the United Kingdom is supplied with the raw material for manufacture principally from China, the East Indies, the Levant, France, and Italy. Of Chinese silks the best come from the provinces of Nankin and Tsekiang in

Hosted by Google

Eastern China. Silk of an inferior character is received from Southern China, through Canton. The principal ports from which we receive East Indian silk are Calcutta and Bombay. The exports from these places amount to 10,000 cwts. annually. Anatolia and Syria produce much good silk, principally around Damascus and Beyruth; this goes chiefly to Western Europe, *viâ* Aleppo, Smyrna, and Constantinople. A great deal of Persian and Armenian silk is brought by caravans from Asia, by Bassora, Bagdad, Damascus, &c., to the ports of the Levant, and goes by the name of silk of the Levant. This name also includes all the silk produced in Turkey, the Morea, and in the Archipelago, and brought into commerce through Gallipoli and Salonica. As the breeding of silkworms only prospers in warm climates, silk culture is confined in Europe to Italy, the south of France, and Spain. There is also considerable silk cultivation on the southern slopes of the Alps, in Tyrol and Illyria, and within the last twenty years successful attempts at silk culture have been made in Bavaria and Lower Austria.

The total quantity of raw silk imported into this country in 1865 was nearly 8,000,000 lbs., and the value of the same manufactured was estimated at more than £17,600,000. Although the climate of England is too cold to enable us to rear the silkworm, we are able to manufacture the silk. We have upwards of 300 silk manufactories, giving employment to 50,000 hands. The principal seats of the English silk manufacture are:—For broad silks, Spitalfields, Manchester, Macclesfield, Glasgow, Paisley, and Dublin; for crapes, Norfolk, Suffolk, Essex, Middlesex, and Somerset; for handkerchiefs, Manchester, Macclesfield, Paisley, and Glasgow; for ribands, Coventry; for hosiery, Derby; and for mixed goods, Norwich, Manchester, Paisley, and Dublin. The annual value of the goods manufactured is computed at £10,000,000. The exports of British manufactured silks are chiefly to the United States and the Colonies. We also

Hosted by Google

ship silks extensively to South America, Germany, Belgium, and even India and France.

Next to the silkworm moth the HONEY BEE (*Apis mellifica*) is the most useful insect to man. This insect belongs to the order *Hymenoptera* (membrane-winged), an order characterised in most of the genera by the presence of a sting. The habits of the honey bee are replete with interest, arising from its social economy and from the separation of the individuals into three communities based on sexual modification, viz., the queens, or prolific females; the workers, or barren females; and the drones, or males.

The hive bee or honey bee is distinguished from the other species of *Apis* by having the femora of the posterior pair of legs furnished with a smooth and concave plate on the outer surface, which, fringed with hair, forms a basket adapted for the conveyance of pollen. A swarm of bees consists generally of about 6,000 individuals, of which about one-thirtieth part are males, the rest females, and of these one only is for the most part prolific, called the "queen." The body of the queen bee is longer, her colours brighter, and her head smaller than these parts in the other bees, and her sting is curved. The male bees or drones have no stings; their body is shorter and thicker. The workers have a straight sting, but as their growth is arrested before the full development of all their organs, they are smaller than either the queen or the drones, and their colours are less bright. The honey bee in its natural state generally constructs its nest in hollow trees, but throughout Europe it is now rarely found except under domestication.

The comb consists of beautiful hexagonal cells, placed end to end in such a manner that each cell is closed by three waxen plates, each of which also assists in completing one of the cells of the other side of the comb. The whole duty of the construction of the comb and the care of the young devolves upon the workers, whose incessant activity has rendered them the symbol of industry.

Hosted by Google

It is a remarkable fact that we derive the greater part of our knowledge of the economy and habits of the hive bee from the labours of a blind man. The elder Huber lost his sight when only seventeen years of age, but by means of glass hives, variously constructed, he was enabled, through the aid of his wife, to become acquainted with all that was going on in them, and from her faithful recital of what she saw, together with the aid of an untiring investigator, M. Burnens, he amassed the material for his celebrated work.

In the construction of the comb the bees take hold of each other, and suspending themselves in clusters, which consist of a series of festoons or garlands crossing in all directions, remain immovable for about twenty-four hours, during which time the wax is secreted in the form of thin plates from between the scales of their bodies. One of the bees makes its way to the roof of the hive, and detaching its plates of wax in succession from the abdomen with the hind legs, works them up with the tongue into the material which forms the comb; this bee is followed by others, which carry on the work. As soon as a few cells are thus prepared, the queen bee begins to exude her eggs. The first eggs develop into workers, the next produce the drones and also the queens. The eggs are deposited in the cells, and in five days the maggot is hatched. The sole employment of the queen bee is the laying of these eggs, and as only one is deposited in each cell, this occupies her almost incessantly. The queen, when thus engaged, is accompanied by a guard of twelve workers, who clear the way before her, and feed her when exhausted, always with the utmost courtesy turning their faces towards her, and when she rests from her labour, approaching her with humility. She "lays workers' eggs for eleven months, and afterwards those which produce drones. As soon as this change has taken place, the workers begin to construct royal cells, in which, without discontinuing to lay the drones' eggs, the queen deposits, here and there, about once in three days,

Hosted by Google

an egg which is destined to produce a queen. The workers' eggs hatch in a few days, and produce little white maggots, which immediately open their mouths to be fed; these the workers attend to with untiring assiduity. In six days each maggot fills up its cell, it is then roofed in by the workers, spins a silken cocoon, and becomes a chrysalis, and on the twenty-first day it comes forth a perfect bee. The drones emerge on the twenty-fifth day, and the queens on the sixteenth."*

As for nearly a year the queen bee does not lay any eggs destined to become queens, if any evil befalls her during that time the hive is left without a queen. Her loss or death stops the work of the hive, and, unless another queen is provided, the bees either join another hive or perish from inanition. After about two days, however, the bees generally decide to provide themselves with a queen, and this state of anarchy subsides. A few of the workers repair to the cells in which their eggs are deposited, three of these cells are made into one, a single egg being allowed to remain in it. When this egg is hatched, the maggot is fed with a peculiarly nutritive food, called "royal bee bread," which is only given to maggots destined to produce queens. Work is now resumed over the whole hive, and goes on as briskly as before; on the sixteenth day the egg produces a queen, whose appearance is hailed with every demonstration of delight, and who at once assumes sovereignty over the hive.

If the old queen should survive, and the young queens emerge from the eggs last deposited by the old queen under ordinary circumstances, the workers do not allow them instant liberty, as severe battles would take place between them and the reigning queen; they are therefore kept prisoners in the cell, and fed through a small hole which is made in the ceiling of their cell, through which these captive queens thrust their tongues and receive their food from the

* "Familiar Introduction to the Study of Insects." By Edward Newman, F.L.S.

Hosted by Google

workers. In this state of confinement the young queen bee utters a low complaining note, which has been compared to singing. When the old queen finds one of these captives, she uses every effort to tear open the cell and destroy her rival; the workers prevent this, pulling her away by the legs and wings. After repeated attempts to penetrate the cells and destroy her royal progeny, the old queen becomes infuriated, communicates her agitation to a portion of her subjects, who, together with her, rush out of the hive and seek a new home. The queen and accompanying swarm generally fly to some neighbouring resting-place, are observed by the owner, captured, placed in a new hive, and a new colony is at once commenced. The labourers that remain pay particular attention to the young imprisoned queens, and these, as they are freed from confinement, successively lead off fresh swarms, if the hive be not enlarged. Each swarm contains not only the recently-hatched young bees, but also a portion of the old inhabitants. After the hive has sent off three or four swarms, there are not enough bees left to guard the royal cells. The young queens, consequently, escape two or three at a time; a battle ensues amongst them, and the strongest remains queen of the hive, after destroying all the royal larvæ and pupæ that remain.

According to Huber there are two varieties of working bees. The nurse-bees, which continue in the hive, whose office is to build the comb and feed the larvæ; and the collecting bees, which fly abroad and bring back to the hive the pollen and honey which they collect. This pollen is formed into little pellets, and packed on the hind legs in the receptacle formed there for this object. Honey is also swallowed by the bee, which passes into the crop, where it accumulates as in a reservoir, and on the return of the bee to the hive is poured into a honey cell. When a pollen-laden bee arrives at the hive, she puts her two hind legs into a cell, and brushes off the pellets with the intermediate pair. These

Hosted by Google

pellets are kneaded into a paste at the bottom of the cell. The softened kneaded pollen thus packed away is called "bee-bread." Besides honey and pollen, bees collect a gum-resin called by Pliny "propolis," principally from the balsamic buds of the horse chestnut, birch, and poplar. This is used in closing up crevices in their hives, and in strengthening the margins of the cells of the comb.

Honey and *Wax* are two valuable commercial articles for which we are indebted to the labours of the hive bee. Bees' wax is prepared by melting the comb in boiling water after the honey has been removed; the melted wax is then strained and cast into cakes, which have a pale yellow colour and a pleasant odour.

White bees' wax is formed by exposing the yellow wax in thin slices or ribands to light, air, and moisture, and then re-melting and forming it into cakes. Wax candles are made by suspending the wicks upon a hoop over a cauldron of melted wax, which is successively poured over them from a ladle till they have acquired the proper size, so that the candle consists of a series of layers of wax; the upper end is then shaped and the lower cut off. Wax is also much used in taking casts or moulds, and as an ingredient in cerates and ointments. It is of great value in anatomy in representing normal or diseased structures. Most of our anatomical museums have very instructive preparations made of this substance.

In addition to the large amount of wax, the annual produce of our own hives, considerable quantities are received from Canada. Africa also sends us heavy supplies. About 300,000 lbs. are annually shipped from Madras. Altogether we use every year in this country about 500 tons of wax, of the value of £200,000.

Honey is abundantly produced in the United Kingdom. Its flavour varies according to the nature of the flowers from which it is collected. Thus the honeys of Crete, Minorca, and Narbonne are flavoured with rosemary, which there

Hosted by Google

grows profusely; the honey from Provence is flavoured with lavender; and the delicious taste and perfume of the honey from Cuba is due to the presence of neroli oil, obtained by the bees from the orange flowers which abound there. Some poisonous flowers are even said to communicate to honey their injurious qualities. The instance recorded by Xenophon, of the Greek soldiers intoxicated by honey gathered from the rhododendron is well known. More than 2,000,000 lbs. of honey are annually imported into the United Kingdom, in addition to that obtained from our own bee-hives.

Blister Fly (*Cantharis vesicatoria*).—This is a small coleopterous insect about three-fourths of an inch long, of a nauseous odour and a brilliant golden green colour. These insects secrete in their bodies a principle which has the power of vesicating or blistering the human skin when applied. For this purpose the beetle is reduced to powder, which, mixed with ointment or lard, is spread thinly upon a piece of leather, and then applied to the part intended to be blistered. The blister fly is found on a variety of shrubs in Spain, Italy, France, &c. It has been taken occasionally in England, but it is much more abundant in Spain; and although we now receive it principally from Astracan and Sicily, it still retains its usual commercial name of Spanish flies. In some years as many as twelve tons of these insects have been shipped from Sicily. Some idea of the immense number destroyed to form that amount may be obtained from the fact that fifty of them scarcely weigh a drachm.

Cochineal (*Coccus cacti*). — This valuable insect was first introduced into Europe in 1523 from Mexico. It belongs to the order of insects called *Hemiptera*, or half-winged. The portion towards the base of each wing is tougher or more coriaceous than the other part of the wing, which is membranous.

The culture of the cochineal insect has extended from the Old to the New World, but been unsuccessful in India, Java, Algiers, and many parts of Europe. The cochineal

Hosted by Google

insect is small, rugose, and of a deep mulberry colour. It feeds on several species of cacti. These insects are scraped from the plants into bags, killed by boiling water, and then dried in the sun. Those are preferred which are plump, of a silvery appearance, and which yield when rubbed to powder a brilliant crimson. It is estimated that 70,000 of these minute insects are necessary to make a single pound of cochineal. In 1855 we imported 1,400 tons of cochineal, valued at £700,000. This quantity would include about 220,000,000,000 insects.

The red colouring matters known by the names of *carmine* and *lake* are made from cochineal. Cochineal is used for dyeing scarlet, and is employed chiefly for woollen goods. The dye is obtained by fixing the colouring matter of the insect by a mordant of alumina and oxide of tin, and exalting the colour by the action of super-tartrate of potash.

Lac Insect (*Coccus lacca*).—The habits and economy of this insect are much the same as those of the cochineal. The lac insect attaches itself to the bark of trees abounding in milky juice—such as the *Ficus Indica* or Indian fig, and the *Ficus religiosa* or Banyan fig—punctures the bark, and causes an exudation of the milky juice; this eventually surrounds the lac insect, her eggs, and larva, producing an irregular resinous-looking brown mass on the branch, which it encircles. The commercial varieties of Lac are *stick lac*, which is the substance in its natural state investing the small twigs of the tree; seed lac, the same substance broken off in small pieces from the twigs, and *shell lac*, consisting of the substance melted and formed into thin cakes. Seed lac and shell lac are the resin left after the dye has been extracted from the stick lac. Lac dye and lac lake are two preparations of the colouring matter of stick lac, imported in small cubic cakes from the East Indies. The colouring matter of these dyes much resembles cochineal, for which it is largely substituted. Upwards of 1,000,000 lbs. are annually imported from Bengal, and 3,000,000 lbs. of shell

Hosted by Google

lac; nearly one-half of it, however, is again exported to Italy, Germany, and other parts of the Continent.

Lac is mainly consumed in the manufacture of dye stuffs, sealing-wax, and of certain varnishes and lacquers. Red sealing-wax has its colour communicated by vermilion; white sealing-wax is made with bleached gum lac; black sealing-wax is a mixture of shell lac and ivory black; and blue sealing-wax is made by colouring the shell lac with smalt or verditer. To make golden sealing-wax, powdered yellow mica is mixed with the shell-lac.

PRODUCTS OF THE SUB-KINGDOM CŒLENTERATA.

Cœlenterata (Greek, *koile*, a hollow, and *enteron*, an intestine) is the fourth primary division of the animal kingdom, and includes all those animals in which the mouth and stomach are not separate from the rest of the cavity of the body. The substance of the body consists of two membranes, which are generally provided with cilia, and contain peculiar urticating organs, termed "thread-cells." A nervous system is absent in most. They have been sub-divided into the following classes:—

1. *Hydrozoa*, in which the wall of the digestive sac is not separated from that of the general cavity, and the reproductive organs are external. Examples: hydra or water-polyp, and jelly-fishes. The latter are called also sea-nettles, because leaving, when touched, a disagreeable sensation, like the sting of a nettle. They have an extremely soft, gelatinous structure, and float and swim in the water by alternate contractions and dilatations of the body.

2. *Actinozoa*, in which the wall of the digestive sac is separated from that of the general cavity, and the reproductive organs are internal. Examples: sea-anemone, sea-pen, sea-fan, red-coral, and coral-polyps.

The latter class only is of commercial importance; it furnishes us with the

Hosted by Google

RED CORAL (*Corallium rubrum*, L.).—This is a marine production, formed by numerous polyps in union with each other, called a polypidom. Recently taken, coral is covered with one continuous living membrane, in which are the polyp cells. These polyps produce the coral, a branched tree-like structure, beautifully red, and very hard, and for this reason much sought after for ornamental purposes. In places where good coral is obtained it forms an important article of commerce. It is abundant in various parts of the Mediterranean Sea. It occurs in the Red Sea, the Persian Gulf, and on the coasts of Spain, France, Corsica, Sardinia, and Sicily. Very fine coral is found between Tunis and Algiers, off the coast of Barbary, where the French and Italians carry on the coral fisheries. Other species of the genus have from time to time been dredged off Madeira and the Sandwich Isles.

Coral always grows perpendicularly on the surface of the rock to which it attaches itself, in whatever position the rock may be placed, and from eight to twelve inches in height. Coral requires from eight to ten years to arrive at its full growth. It is dredged up from depths varying from 10 to 1100 fathoms. Its value depends on its size, solidity, and the depth and brilliancy of its colour. Some of the corals in the market are worth from eight to ten guineas an ounce, whilst other kinds will not fetch one shilling a pound.

Coral is made up into a variety of ornamental articles. The principal towns where it is worked are Marseilles, Genoa, Leghorn, Naples, and Frapani. In Persia, China, and Japan, coral ornaments, in the form of necklaces, bracelets, rings, &c., are still valued as highly as gold, and large quantities of them are manufactured in Naples for the Eastern market.

Stone Corals, under the name of brainstones, millepores, madrepores, harp corals, and cup corals, are well-known drawing-room and mantel-piece ornaments. When living, they were covered with fleshy matter, from which projected the

Hosted by Google

polyps which gave the peculiar markings to their surface. The fleshy mass was removed, and the coral was then bleached, and obtained its beautiful white colour by exposure to the air and sun. These corals occur in prodigious quantities in the South Pacific Ocean, where they form the reefs and islands so abundant there.

PRODUCTS OF THE SUB-KINGDOM PROTOZOA.

Protozoa, or first animals (Greek, *protos*, first, and *zoon*, an animal). Examples: Infusoria, or animalculæ developed in vegetable infusions, and sponges.

SPONGE (*Spongia officinalis*, L.).—This organism is now acknowledged by naturalists as belonging to the animal world. A piece of sponge shows on its surface an indefinite number of minute holes, amongst which there are larger openings scattered. When alive and in the water, currents of water are seen to enter the smaller openings, which, after passing through the body of the sponge, are ejected out of the larger orifices. Nutritive matter is conveyed by these currents into the body of the sponge, and fæcal matter is at the same time removed. A coating of living gelatinous matter is spread all over the fibres of the sponge, in consistence like the white of an egg. This runs away freely from the sponge when the latter is taken out of the water. Nothing then remains visible but the sponge, which is, in fact, the horny skeleton or structure formed by the labours of the animals constituting the gelatinous coating.

Sponges occur in all seas, from the equator to the poles, but they attain their greatest size and perfection in the tropics. They grow on anything which will serve them as a point of attachment, covering rocks, shells, seaweed, and even living animals. Thus, Dr. Johnson, in his "Natural History of British Sponges," mentions the case of a sponge which was found growing on the back of a living crab, and

Hosted by Google

so large that it was "a burden apparently as disproportionate as was that of Atlas;" the creature not appearing at all to be inconvenienced, for it was "big with spawn, in a state nearly ready for laying. Indeed, the protection which the crab derived from the sponge might more than compensate for the hindrance thus opposed to its freedom and activity. When at rest, its prey might seek, without suspicion, the shelter afforded amid the thick branches of the sponge, and become easy captives; while, when in motion, scarcely an enemy could recognise it under such a guise, and the boldest might be startled at the sight of such a monster."

Several kinds of sponge come into the market, but the most valuable, and those also most in general use, are called Turkey and West India sponges. The former is considered to be the best. The tubes and orifices of the Turkey sponge are smaller than those of the West India variety; it is also more durable, and less easily torn. The Turkey sponge is obtained from the Mediterranean, where it grows on rocks and stones at the bottom of the sea in masses from the size of an egg to that of a man's head. Our supplies are received from Cyprus and Candia, from the shores of Anatolia, and from several islands of the Grecian Archipelago, especially from the small island of Symis or Syme, whose inhabitants are said to be the best divers. The coast of Syria furnishes the finest toilette sponges, valued at from 35s. to 40s. per pound; ordinary sponge costing only 10s. per pound. Inferior sponge, with a large-holed texture, called horse sponge, comes from the coasts of Barbary, Tunis, and Algiers. The annual importation into the United Kingdom amounts to between 200,000 and 300,000 pounds, valued at £80,000. The coarser sponges come principally from America. Very large ones are obtained from the Bahama banks and the coast of Florida.

The property which sponge possesses, of absorbing water into its tubes and retaining it until squeezed out, renders it valuable for all purposes involving washing and cleansing.

Hosted by Google

PART IV.

COMMERCIAL PRODUCTS OF THE MINERAL KINGDOM.

RAW PRODUCE.

I. Metals and Metalliferous Minerals.

Iron: *Magnetic iron ore, titaniferous iron ore, red hæmatite, brown hæmatite, spathic ores, clay ironstones, other ores. Process of smelting, puddling, &c.; steel, supply of iron.* Gold, silver, quicksilver, platinum, tin, copper, lead, zinc, aluminium, antimony, bismuth, cobalt, arsenic, manganese, chromium (*with their chief ores, uses, localities, &c.*).

II. Earthy Minerals.

(a) Coals and allied substances.

Coal: *Lignite, bituminous coal, steam coal, anthracite. Supply of coal.* Jet, amber, *naphtha, petroleum,* asphalt, mineral pitch.

(b) Limestones, Limes, and Cements.

Common limestone, ornamental limestones, and so-called marbles; marble, coral limestone, marl, calcareous sand, gypsum; *composition of limes, stuccoes, and cements.*

(c) Siliceous and Felspathic Substances.

Rock crystal, quartz, and flint; sandstones, paving, mill, and building stones; siliceous sands, rottenstone, Bath bricks, Tripoli powder, Bilin powder, berg-mehl, tellurine.

(d) Igneous and Metamorphic Rocks.

Granites: *Syenite,* mica, talc, asbestos, serpentine, basaltic rocks; *greenstone, whinstone, trap,* lava, obsidian, pumicestone, pozzuolano, and trass.

Hosted by Google

(e) Clays and allied Substances.

Common clay, yellow, brown, and blue; kaolin and petuntse, pipe clay, fire clays, *Stourbridge clay*, fuller's earth, red and yellow ochres, slates, hone stones.

(f) Earths of Sodium, Potassium, Boron, Sulphur, &c.

Common salt, rock salt, soda, *chlorine*, alum, natron, borax, saltpetre or nitre, cubic nitre, heavy spar, celestine, strontianite, fluor spar, sulphur, *sulphuric acid*, graphite or plumbago; mineral manures, *phosphates of lime.*

(g) Precious Stones.

1. Carbonaceous: diamond.
2. Aluminous: ruby, sapphire, emerald, topaz, corundum, garnet, beryl.
3. Siliceous: amethyst, cairngorm stone, opal, sardonyx, agate, chalcedony, carnelian, jasper, lapis-lazuli, turquoise.

I. *METALS.*

IRON.

This valuable and indispensable metal is, in a variety of forms, almost universally diffused throughout the earth. It is of incalculable use in all the appliances of modern civilisation—in machinery of every description, instruments, implements, and tools of all kinds; architecture and domestic fittings and utensils; conveyance, both inland and maritime; apparatus for warming, lighting, and water supply; and even in medicine, to impart renewed vigour to the failing human frame. It occurs in all parts of the earth, in all geological formations, to which it contributes a great part of their colouring matter; it is found in all spring and river waters; and it enters into the composition of both plants and animals. It is present too, as the principal ingredient, in the extraordinary fragments called meteoric stones, and is thus a constituent of worlds beyond our own. It can be melted and cast into moulds, softened, and hammered out

Hosted by Google

into plates, drawn out into bars and wires, tempered to almost any degree of flexibility, hardened so as to scratch glass, and sharpened to the keenest cutting edge. In some of its natural forms, and also when heated to redness, iron is highly magnetic. Pure iron is white, or greyish-white, lustrous, soft, and tough, and it is one of the most infusible of metals (fusible at 3,480° F.). Its specific gravity is 7·84. When beaten out it appears granular in structure; when drawn, fibrous; and to this latter peculiarity is attributed its extraordinary tenacity.

Metallic iron as it occurs in meteoric stones is usually alloyed with nickel and other metals, but its occurrence as terrestrial native iron, is doubtful. There are many minerals containing iron, but of these only the oxides and carbonates are so used by the smelter; they are magnetic iron or loadstone; specular and micaceous iron ores; the red and brown hæmatites; the spathose ore and the clay ironstones.

The maximum development of iron ores appears to be in the palæozoic rocks, the largest and richest deposits being contained in the Laurentian rocks of North America and Scandinavia; they are abundant in the Devonian rocks of Germany and south-west of England. The Carboniferous system is especially marked by the presence of interstratified argillaceous carbonates both in America and Europe. The celebrated kidney ore of Cumberland is found in Permian strata, the Secondary rocks are rich in bedded deposits of ironstone, and the Tertiary series yields limonites.

Magnetic iron ore, or *Magnetite*, is the black oxide (Fe_3O_4, or $FeO + Fe_2O_3$), and contains 72·41 per cent. of iron. It occurs in many parts of the earth in immense masses, forming the substance of hills and even mountains, as in the mountain of Blagod among the Urals, and in some hills of Swedish Lapland, Mexico, and Styria. In Canada magnetite is found abundantly in the gneiss and crystalline limestones constituting the Laurentian rocks; it occurs in irregular beds, often of considerable thickness, in one in-

Hosted by Google

stance as much as 200 feet. In the State of New York this mineral occupies the Valley of Adirondac and its neighbourhood for a mile in width and twenty miles in length. In our own country it occurs in Dartmoor, at Rosedale, and in Antrim; and it is found also in New Jersey, Pennsylvania, Nova Scotia, and parts of the East Indies. This ore is not only the richest in pure metal, but furnishes also the finest qualities. It is remarkable, however, that some veins, without any apparent chemical difference, produce finer iron than others. The produce of the mines of Dannemora in Sweden is of the finest description, and is employed in the production of the highest class of steel. Magnetic iron ore occurs chiefly in veins and fissures in diorites or dolerites, or in interstratified masses in metamorphic rocks.

Titaniferous iron ore contains proto- and per-oxide of iron, titanic acid (an oxygen compound of the metal titanium), and magnesia in variable proportions. The bar iron or steel made from titaniferous iron ore possesses unusual strength and a peculiar mottled appearance. This ore is chiefly employed with others to impart a high degree of toughness to the metal produced.

Red hæmatite is a sesquioxide of iron (Fe_2O_3) with seventy per cent. of iron. It is distinguished from the less rich brown hæmatite by its red streak, that of the latter mineral being brown in colour. Red hæmatite is known by special names, according to its different varieties:—

Specular iron ore, oligiste, or *iron glance,* is brilliant, hard, and distinctly crystallised. It is found in Elba, Brazil, &c.

Micaceous iron ore is scaly, crystalline, loosely coherent, and similar to graphite in structure. It is met with in South Devon.

Kidney ore is a hard botryoidal variety, devoid of lustre, such as that of Cumberland.

Red ochre is a compact, earthy, and more or less clayey variety, and is usually employed in the preparation of red and yellow ochres and umbers.

Hosted by Google

Red hæmatite occurs abundantly in England and Wales, and, being rich, is much used for mixing with the poorer ores of the coal formations in the process of smelting. The red ore is worked in Cumberland, at Ulverstone, in Forest of Dean, Cornwall, North Wales, Ireland, Belgium, Nova Scotia, Elba, Sweden, Missouri, and the neighbourhood of Lake Superior.

Brown iron ore or *hæmatite* consists essentially of three equivalents of water united to two of peroxide of iron, or 2 Fe_2O_3 + 3 H_2O, and is compact and earthy.

Gothite is another hydrated oxide (Fe_2O_3 + H_2O), but it is crystallised. Both minerals are usually included in the smelter's term "brown hæmatite," and, though resembling the red in outward appearance, are distinguished by their brown streak. Bog iron ores, and those deposited in the beds of lakes by the action of infusorial life, belong to this group of iron ores.

Brown hæmatites are largely worked in the Carboniferous rocks of England and South Wales; in the Lias of Oxfordshire, Northamptonshire, and Yorkshire; in the Lower Greensand near Devizes, and in Buckinghamshire; in Oolitic strata in France, Bavaria, Wurtemburg, Luxemburg, &c.; and in the Wealden rocks of the Boulonnais. Bog-iron ore is abundantly developed in North Germany, Sweden, Norway, Finland, and Canada.

Siderite, spathose iron, or *brown spar*, is a carbonate of the protoxide of iron (FeO, CO_2), or commonly speaking, carbonate of iron. The spathic ores are sparry or crystalline, and are associated with varying quantities of carbonate of lime and of magnesia. Spathic ore, when pure, is white; but it becomes reddish on exposure to the air. It is particularly abundant in Styria, where the mountain Erzberg, near Eisenerz, is capped by the mineral to a thickness varying from 200 to 600 feet; in Carinthia and other parts of Austria; at Siegen, in the Stahlberg, or "steel mountain" (Rhenish Prussia); and in the United States

Hosted by Google

(New York and Ohio). The principal English deposits are those of Weardale, in Durham; Exmoor, Devonshire; and Brendon Hill, in Somersetshire.

Clay ironstone is an amorphous argillaceous carbonate of iron, mixed with small quantities of lime and magnesia, and sometimes, as in the "black band," with bituminous matters. The poorest of the serviceable ores, they are, nevertheless, in Britain, the most important, furnishing nearly two-thirds of the total yield of iron. Being mostly connected with the Coal formations, they are cheaply worked, having in immediate proximity a plentiful supply of fuel and limestone for their reduction. There are many varieties—that called the "black band" being among the most valuable, from the ease and cheapness with which the ore may be calcined, by burning it in heaps without any additional fuel.

The ores are extensively worked in South Wales, Monmouthshire, Shropshire, Staffordshire, Yorkshire, Derbyshire, Lanarkshire, Stirlingshire, County Antrim; in Belgium, Silesia, United States, North China, Japan, India, Brazil, and Tasmania. Ireland has large deposits, which are not much worked. Clay ironstones are not confined to the Carboniferous rocks, but are extensively met with in the Lias, Oolite, and Wealden, and even among Tertiary rocks. Of this character are the rich iron district of Cleveland, in Yorkshire, and similar deposits in France.

Iron pyrites, *mundic*, the bisulphide of iron (FeS_2), is diffused through rocks of all ages, but the presence of sulphur makes it of little value for the production of iron. It is important, however, both directly as a source of sulphur and sulphuric acid, and indirectly in the immense number of the useful applications of this latter product. Pyrites sometimes contains gold, and it is then called *auriferous pyrites*. Wicklow, Cleveland, Bohemia, Spain, Portugal, and Norway possess very large quantities of this mineral.

Hosted by Google

Phosphates of iron are worked in Canada, and *silicates* in Switzerland.

The principal processes to which iron ores have to be subjected, in the preparation of iron and steel for manufacturing purposes, are roasting and smelting, refining and puddling, cementation and tempering—varying with the nature of the ores. The roasting process—chiefly necessary for impure ores—gets rid of combustible matter, water, and carbonic acid. The smelting, conducted in large blast furnaces, disengages the metal from the oxygen and earths of the ores, and brings it into the marketable form of cast iron, in pigs. This is really a carbide of iron, containing a considerable proportion of carbon, with small quantities of some other substances, such as silica and potash, derived either from the ores or the fuel. It is very brittle, and suitable only for castings; and, according to its quality, it is grey iron, which is the best; mottled; and white, which is the worst. Refining, a re-melting of the metal with coke or charcoal, removes some of the carbon and silicon, and produces what is called fine metal. The puddling, which is carried on in a reverberatory furnace, disengages further quantities of these impurities, and makes the iron malleable, prepared in bars or sheets, as required. By cementation, or heating with charcoal, bar iron is made into blistered steel. From this, by welding, shear steel is made; and, by re-melting and casting, the cheaper cast steel is obtained. Spathose pig-iron can be converted into steel without any intermediate processes. This is done in Styria and other parts of the Continent, and in Borneo. The produce is called natural steel, and is of very fine quality. Ordinary cast iron, annealed, called "run-steel," can sometimes be substituted for steel. The tempering of steel, to adapt it, as regards hardness and ductility, for its various purposes, is effected by the processes of re-heating and sudden cooling—the temperature being made to vary with the quality sought to be produced.

Hosted by Google

The quantity of iron produced from the principal mining countries is nearly as follows :—

	Tons.		Tons.
Great Britain	4,819,254	Russia	200,000
France (1867)	1,035,000 (and upwards)	Belgium	200,000
		United States	750,000
Prussia and Zollverein	400,000	Spain	80,000
Austria	250,000	Italy	48,000
Sweden and Norway.	150,000	Other sources, about ...	300,000

From these figures it appears that the British produce of iron is more than double that of the rest of the globe.

GOLD.

This noble metal is unaffected either by air or water, and is of great and almost universal use. In civilised countries it forms, as coin, the principal medium of exchange, besides being used in the form of gold-dust for a similar purpose among semi-barbarous nations ; and from the richness of its colour and its imperishable nature, it enters very largely into the composition and ornamentation of such articles of utility and luxury as require to be both durable and beautiful. For all these purposes it is peculiarly fitted by its weight (sp. gr. 19·5) and its extraordinary malleability and ductility. In virtue of these latter qualities it can be hammered out into leaves of 282,000 to an inch, and a single grain can be extended into 500 feet of wire. Its natural softness can be corrected by a slight alloy of silver or copper, and in this state it is commonly employed.

Gold is more generally diffused throughout the globe than any other metal except iron, but not in all places in sufficient abundance to render its collection or extraction profitable. It occurs mostly native, being either pure or alloyed with silver, tellurium, and other metals ; and often associated with the sulphides of iron and silver.

The modes of occurrence and association of gold are as follows :—

1. In quartz veins of the older rocks, those in the Lower

Hosted by Google

Silurian containing the greatest quantity of gold. Examples are furnished by the auriferous lodes of North Wales.

2. In quartz veins in such Secondary rocks as have been penetrated by certain igneous eruptions, either in the intrusive rock, or in the Secondary strata, and then for a limited distance only beyond the junction of the two rocks. Such an association prevails in California, Central America, and Peru.

3. As auriferous detritus in Secondary and Tertiary deposits, and in the débris and alluvia of rivers, such having been derived from gold-bearing rocks. The *placer* mining of California, Australia, New Zealand, &c., is prosecuted in superficial drift deposits. Gold has been found in streams in Cornwall, Devonshire, Wicklow, and Scotland; and the sands and alluvia of rivers in many parts of the world are washed for this metal.

Our great supplies are drawn from all these sources. The chief are Australia and New Zealand, California and British Columbia, Brazil, Peru, Mexico, and Central America; the Ural, Altaï, and Carpathian Mountains. Gold is also obtained from Thibet, China, Japan, Further India, and Borneo; from the sands of African rivers, especially in Guinea, and from those of the Rhine, Rhone, Danube, and Tagus. Small quantities are procured in mining districts from iron and arsenical pyrites, and other sources, as in Silesia, Saxony, and parts of our own country. The total annual supply is about as follows :—

Australia	£12,000,000	South America	£500,000
New Zealand (1868)	2,504,326	East Indies	500,000
California	13,000,000	Africa	200,000
Russia	3,000,000	Austria	200,000
Mexico and Central America	500,000	Britain	3,000
		Nova Scotia	90,000

PLATINUM.

Platinum ranks with gold in its resistance to the in-

Hosted by Google

fluence of air, moisture, and the ordinary acids, and is the heaviest substance known (sp. gr. 21·5). It is white, exceedingly malleable and ductile, and extremely difficult of fusion. On account of its indestructibility it is of great use in the laboratory for crucibles. It is valuable in the arts, and has been employed for coinage by Russia.

Platinum rarely occurs pure. It is principally found alloyed with palladium, rhodium, iridium, iron, gold, or other metals, and generally in alluvial deposits. In the Ural Mountains it has been observed disseminated throughout the whole mass of certain crystalline rocks. The pure metal is got by adding sal-ammoniac to a solution of the alloy in nitro-hydrochloric acid, and washing and heating the compound thus produced. The sources of supply are the Ural Mountains, Brazil, Peru, Spain, Borneo, and Ceylon. The quantity furnished by Russia is 800 cwts.

SILVER.

Silver, like gold, is a noble metal, and is used very extensively for similar purposes. It also needs an alloy to harden it; and being less precious, as well as less weighty (sp. gr. 10·5), is more available for common uses, especially many domestic ones. Its chemical preparations are valuable in photography and surgery. In colour silver is a beautifully brilliant white; it is sonorous, highly malleable and ductile, and perhaps the best conductor of heat and electricity.

This metal occurs pure in some rocks in very fine threads, and large masses of pure silver are occasionally met with in veins. But its supply is principally derived from ores, of which the chief are the *chloride* (AgCl), or *horn-silver*, a greyish crystalline mass, which looks like horn; the *sulphide* or *silver-glance*, and its combinations with the sulphides of antimony and arsenic, which are known as the dark and light red silver ores; and *argentiferous galena*

Hosted by Google

(sulphide of lead), which often contains very considerable quantities.

Silver is obtained from its ores chiefly by roasting, crushing, and amalgamation with mercury. The separation from lead was formerly effected by the superior affinity of lead with oxygen in the process called cupellation, which was in every way costly; and unless the per centage of silver in the lead was large it was not separated. A process, known as Pattinson's, is now employed for desilverising lead; it is based upon the discovery that lead crystallises or consolidates at a higher temperature than an alloy of lead and silver; consequently, if argentiferous lead be kept at the lowest temperature at which the fluid state could be maintained, solid masses of pure lead are gradually formed and removed, the fluid portion remaining being exceedingly rich in silver; finally, the lead is subjected to the process of cupellation, and the silver separated.

The most abundant supply of silver is yielded by the mines of Mexico, Chili, and Peru, especially those of Pasco. These mines occur in elevated districts, some upwards of 16,000 feet above the sea level. Considerable supplies are also obtained from other parts of South America, in the Ural and Altaï Mountains, from China, Japan, Cochin-China, Thibet, Asiatic Turkey, Norway and Sweden, the Hartz Mountains, Saxony, Hungary, Austria, and the lead districts of the British Isles. The annual quantities are :—

Mexico	£2,420,000	Britain	£180,000
South America ...	1,650,000	France	60,000
Zollverein	450,000	East Indies (1860) ...	50,000
Spain	400,000	Norway and Sweden ...	30,000
Austria	250,000		

MERCURY.

This extraordinary metal—quicksilver, as it is often called—fluid at ordinary temperatures, is the heaviest liquid with which we are acquainted (sp. gr. 13·59). It becomes

Hosted by Google

solid at – 40° Fahrenheit, when it is both malleable and ductile. It is used for the extraction of gold and silver; as an amalgam in chemistry, and in the construction of scientific instruments; in manufactures, for silvering mirrors, and for vermilion; and in medicine, for the valuable products calomel and corrosive sublimate, the subchloride and chloride of the metal respectively.

Quicksilver is met with pure in minute globules, but for the purposes of commerce it is obtained from one of its ores—*cinnabar*, a red sulphide of mercury. This ore occurs in the older rocks, but chiefly in those of the Carboniferous System, and the metal is procured from it by a process of distillation. The principal sources of supply are Almaden in Spain, and Idria in Austria, both very rich; Peru, California, Mexico, Australia, China, Japan, Ceylon, Bavaria, Bohemia, Tuscany, and Hungary; and the quantities of mercury annually obtained, are about as follows:—

Austria	...	...	...	500,000 to	1,000,000	pounds.
Spain	...	...	...	...	...	3,500,000	,,
California	...	...	...	...	...	1,500,000	,,
Peru	...	...	...	...	...	324,000	,,
Germany	...	...	...	...	...	21,000	,,
Tuscany	...	...	...	...	...	55,000	,,

TIN.

This very useful metal is rather a rare one. It is but slightly acted upon by either air or water, is of a white silvery colour, malleable, and easily fused. Its specific gravity is 7·3. Besides being largely used in coating or tinning more oxidable metals, as iron, for instance, in the well-known material called tin-plate, and combining as an alloy to form pewter, bell-metal, type-metal, and solder, it is employed in its chemical combinations for a great variety of purposes in the useful arts. It is found as an oxide, chiefly in the metalliferous veins of the older rocks, also in association with wolfram (a double tungstate of iron and manganese), and, like gold, in alluvial districts, as stream tin.

Hosted by Google

By the processes of roasting, smelting, and refining, the stream ores produce the grain tin, which is the most esteemed, and the others the bar or block tin. The most productive districts are Cornwall and Devonshire, the Malayan Peninsula and islands, especially Banca and Billiton, to the south of it, and Tenasserim, in the East Indies, China, Saxony, Bohemia, Hungary, Peru, New Granada, Bolivia, Mexico, France, Spain, Siberia, and Australia. Annual supply, about—

	TONS.		TONS.
Britain	10,000	Japan	113
China	127	Australia (Victoria) ...	816
Austria	30	Siam	53
East Indies	5 000		

COPPER.

Copper is a metal of great commercial value, and of very extensive use. It is of a fine red colour, very malleable, ductile, and tenacious, highly sonorous, and a good conductor of heat and electricity. Its specific gravity is 8·96. Independently of its use for coin, sheathing for ships, boilers, and domestic utensils, and of its alloys with gold and silver to harden those metals, copper enters into the composition of brass, bronze, pinchbeck, ormolu, gun-metal, bell-metal, German silver, and the biddery ware of India. It is also largely employed in the production of colours (blue and green), in telegraphy, and in medicine.

It occurs native in fine threads, and occasionally in large masses, the most remarkable of which have been found in Brazil, the district of Lake Superior, and Australia. The principal ores, which occur either in veins or beds, and are most abundant in the primary rocks, are copper pyrites, a sulphide of the metal combined with sulphide of iron; the red oxide (Cu_2O), the black oxide, the green and blue carbonates of copper, and the purple and grey copper ores, the latter associated with iron, antimony, and arsenic. The reduction

Hosted by Google

of the ores is a matter of some difficulty. In Britain it is chiefly carried on in the neighbourhood of Swansea.

Ores of copper are found in Cornwall, Devonshire, Flintshire, Wicklow, and other parts of the British Isles; Chili, South Australia, the Ural Mountains, United States and Canada, near Lakes Superior and Huron; associated with trap rock in Brazil and Cuba; in the copper schists of Mansfeld, in the Harz, Saxony, and other parts of Germany; in Sweden, Tyrol, Hungary, Tuscany, Spain, Persia, India, China, Japan, Algiers, South Africa, and New Zealand. Malachite, a beautiful ore of copper (carbonate), found abundantly in Russia and Australia, can be used as an ornamental stone. The annual supply of copper may be thus stated :—

	TONS.		TONS.
Britain	12,000	Sweden	2,000
Chili	21,000	Cape of Good Hope (ore)	4,327
South Australia	6,700	France	3,000
Austria	2,330	United States (Lake Superior)	3,000
Zollverein	2,650		

LEAD.

This metal, the heaviest of the baser metals (sp. gr. 11·45), is soft, easily fused, and very slightly sonorous. It is largely used in roofing, lining, plumbing, and bullet and shot making. It also enters into the composition of pewter, solder, and type-metal; and in its chemical combinations it forms litharge (the oxide), a yellow paint; red lead (red oxide), a cheap substitute for vermilion; white lead (carbonate), manufactured on an immense scale for the painter; and sugar of lead (the acetate), of great value to the chemist. These substances are highly poisonous.

The most abundant and important of the ores of lead is *galena*, a sulphide of the metal, yielding eighty-six per cent. of lead, and almost always containing silver, which is separated when the quantity is not less than four ounces to the

Hosted by Google

ton. The other ores are : the *carbonate of lead*, the *vanadiate of lead*, the *cupreous sulphate of lead*, and the *arsenio-phosphate* of lead. Galena is found very abundantly in the limestones of the Carboniferous series, and to a less extent in older rocks. Its reduction is effected by pounding, washing, and smelting in a reverberatory furnace. Lead mining is carried on in Britain (Northumberland, Cumberland, Durham, Derbyshire, Flintshire, Cornwall, Isle of Man, and Lead-hills), also in Spain and Portugal, France, Belgium, the Harz Mountains, Saxony, Rhine Provinces, Bohemia, Carinthia, Hungary, Norway, and Sweden; Altaï Mountains, China, and Indo-Chinese Peninsula, South Africa, Peru, California, United States, and Canada. Annual supply, about—

	TONS.		TONS.
Britain	67,000	Spain	313,000
Austria (with litharge) ...	6,800	Sweden	500
Zollverein	38,800	France (metriquintals) ...	20,000

ZINC.

This metal, of a bluish-white colour, and specific gravity about 7, has the remarkable peculiarity of being malleable and ductile only between the temperatures of about 250° and 300° F., and of retaining its malleability when cooled. It forms a cheap substitute for many of the applications of lead, such as tanks, pipes, roofs, and for bronze in ornamental works. It enters into the composition of brass, and is used in domestic manufactures, printing, engraving, sheathing of ships, coating of galvanised iron, electrical apparatus, and medicine. Its oxides form valuable white and grey paints.

The principal ores of zinc are, *calamine*, a carbonate (ZnO,CO_2) ; *blende* or *blackjack*, a sulphide ; and a silicate or *electric calamine*. They occur often in association with the ores of lead, and frequently with the ores of copper and tin, chiefly in limestones of the Carboniferous and Devonian Systems. The pure metal is obtained by roasting and dis-

Hosted by Google

tillation, as it is very volatile at a red heat. The ores are largely worked in Belgium, Silesia, Rhine Provinces, and Hungary. Zinc is also produced in Flintshire, Derbyshire, Cumberland, Cornwall, Devon, Ireland, Wales, Isle of Man, Sweden, Bohemia, Carinthia, Spain, the Harz, Canada, New Hampshire, and New Jersey, in which last place, the metal occurs in the mineral red zinc ore, an oxide of zinc. The annual production of zinc in different countries is :—

	TONS.		TONS.
Britain	4,460	Sweden (ore)	10,000
Silesia	36,000	Zollverein	76,000
Austria	1,500	Belgium	16,000
Spain	1,000	United States	5,000

ALUMINUM.

This metal is white, resembling silver, and is of low specific gravity (2·6). It exists abundantly in nature as the metallic base of argillaceous and felspathic rocks, which are silicates of alumina, and as sulphate of alumina, an important constituent of the alums. The pure metal has lately been obtained in quantities available for manufacturing purposes; and from its extreme lightness, its freedom from tarnishing, and its sonorousness, promises to become a most useful product. The metal can be separated from the earth alumina, or from the chloride; but it is obtained economically only from *Cryolite*, a double fluoride of aluminum and sodium, found in Greenland.

ANTIMONY.

Antimony is white and brittle, with a specific gravity of 6·8. As a simple metal it is not used, but it forms valuable alloys. With lead and bismuth it is largely used in the preparation of type-metal, which consists of six parts of lead and two of antimony; with lead and tin for plates on which music is engraved, and with the same for stereotype

Hosted by Google

metal. A small proportion of antimony combined with tin forms hard pewter, and with tin, bismuth, and copper, the white or Britannia metal. It is also very extensively employed in medicine. It occasionally occurs in nature pure, but usually combined with sulphur, or sulphur and lead; it is also found in combination with arsenic, and with nickel, silver, and copper.

Grey Antimony, a tersulphide, affords nearly all the antimony of commerce; it is found in Hungary, Saxony, and the Harz, Belgium, France, Italy, Spain, Siberia, Mexico, Malacca, the Indian Archipelago; was at one period produced in considerable quantities in Cornwall and Dumfriesshire; but now the principal part of our supply of antimony is from Borneo and the East Indies.

Central Italy furnishes 700 tons; Spain, 58 tons.

BISMUTH.

Bismuth is a brittle reddish-white metal (sp. gr. 9·9) which fuses at a very low temperature. It fuses still lower in combination with lead and tin, with which it is used as a solder, and with which it also forms the metal called "Newton's" fusible at the boiling point of water. It enters, too, into the composition of Britannia metal, pewter, and type-metal, and is of some use in medicine. It is found, tolerably pure, usually associated with ores of tin, copper, and silver, in Cornwall, France, Bohemia, Saxony, and Sweden.

COBALT.

Cobalt is a white, brittle, and very tenacious metal. Its specific gravity is 8·5, and it is strongly magnetic. It is very useful in its chemical preparations as producing fine colouring substances, chiefly blue, such as smalts, cobalt-ultramarine, and zaffre or saflor (a corruption from sapphire). The principal ores are cobalt-glance, a combination with arsenic, the black oxide, and cobalt bloom; they are found

Hosted by Google

in Norway and Sweden, Saxony, Hungary, Rhenish Prussia, and United States. The annual yield of zaffre or smalt amounts to, in Saxony, 8,000 cwts.; Bohemia, 4,000 cwts.; Prussia, 600 cwts.; Norway, 4,000 cwts.

NICKEL.

This metal is also found combined with arsenic. It is white, malleable, and but slightly affected by air and moisture. Its specific gravity is 8·5, and it is magnetic until subjected to great heat. With copper it forms German silver, and its alloys form excellent bases for electro-plating. A fine green colour is obtained from its preparations. Nickel has been used in the United States for coin. Its chief ore, "kupfernickel" or speiss, often associated with cobalt, is found in Westphalia, Saxony, Hesse, Hungary, and Sweden. Nickel occurs in meteoric iron.

ARSENIC.

Metallic arsenic is grey, highly lustrous, crystalline, and brittle (sp. gr. 5·7). The arsenic of medicine is the white oxide, or arsenious acid, a virulent poison; this is also largely employed in preparing some of the finer skins and furs of Russia. This metal enters into the composition of some valuable pigments, especially a brilliant green and an orange red. It is also combined with lead in the manufacture of shot. Arsenic is rather widely diffused; and although sometimes pure, it is usually found combined with other metals, with sulphur, and with oxygen. The chief amount is obtained from the arsenides of iron, nickel, and cobalt, and the supply is chiefly derived from Bohemia, Hungary, Saxony, Salzburg, Transylvania, Rhine Provinces, and France. *Realgar*, a red sulphide (AsS_2) is found in Bohemia and Saxony; and *orpiment*, another sulphide (AsS_3) a fine yellow, in China and South America.

Arsenic is also procured from the tin mines of Cornwall; the produce of which was, in 1866, 1,116¾ tons.

Hosted by Google

MANGANESE.

Manganese oxidises at ordinary temperatures, and is never used in the arts in the pure state. It is of a reddish hue, brittle, so hard as to scratch glass, and has a specific gravity of 7·13. The binoxide (MnO_2), is an important article of commerce largely employed in glass manufacture and for colouring pottery, and by the chemist in the preparation of oxygen. Sulphate and chloride of manganese are used in calico printing; the former gives a valuable brown dye. It is found that a slight addition of this metal much improves the cast steel made from British iron. The principal ores of manganese are *Pyrolusite* and *Psilomelane*, both binoxides, the former anhydrous, the latter containing 1 per cent. of water. *Wad*, an impure manganese ore, may be employed, like the preceding, in bleaching, and also for umber paint. Manganese ores are procured from the Harz Mountains, Piedmont, France, Spain, Nova Scotia, Somerset, Devon, Isle of Man, and were formerly obtained from Cornwall, Italy, &c. Britain produces 5,000 tons.

CHROMIUM.

This metal, in its pure state brittle, difficult of fusion, and like iron in colour, is important in the arts for the beautiful colours produced by its combinations. The most important of these are the sesquioxide of chromium, a fine green, bichromate of potash, and bichromate of lead, yellow and orange. The principal ores are chromic iron (chromate of iron) and chromate of lead, the former occurring usually in serpentine rocks in the Shetland Isles, France, Norway, and the United States, and the latter in Siberia, the Urals, and Brazil.

II. *MINERALS PROPER.*

COAL.

Coal is a mineral substance very generally diffused throughout the earth's surface; it occurs of different geo-

Hosted by Google

logical ages in various parts of the world, but by far the greater proportion of valuable workable coal is derived from the Carboniferous series of formations. Good workable coals are obtained in the Lias and Oolite; brown coals and lignites are of Tertiary age. Coal consists of vast collections of carbonised vegetable matter impregnated in varying degrees with the pitchy and resinous substances now so characteristic of the fir family. Peat bogs in superficial beds present perhaps the first stage in such a change. These masses of vegetable matter, though containing much water, can be made available for house fuel, fuel for manufacture, very fair charcoal, and for the extraction of naphtha, paraffin, tar, &c. In the presence of an abundant supply of coal, peat cannot be economically employed, but it is extremely useful where coal is scarce, as in Holland, many parts of France, Germany, and Ireland. A nearer approach to true coal is the lignite, woody, or brown coal. This mineralised vegetable product, like peat, contains a considerable quantity of moisture, and it suffers in quality on exposure to the air. It is a Tertiary deposit, and is found in Breslau, on the Rhine, in Germany, on the Danube, and the shores of the Baltic, in Styria, Tuscany, Nova Scotia, New Zealand, Devonshire, and County Antrim. True coal is very compact, has for the most part lost its woody and fibrous character, and contains a very small quantity of earthy matter. It consists of two principal varieties, the bituminous and the anthracitic. Bituminous coals contain a large proportion of gas, tar, paraffin, and such substances, and burn therefore with a brilliant flame. They are, hence, peculiarly adapted for domestic consumption, for gas, manufactures, coke, &c. The bituminous coal richest in volatile constituents is the variety called "Cannel"—in Scotland the "Parrot"—which burns with great brilliancy. Other varieties are splint and cubic coals. A semi-bituminous coal, burning with less brilliancy and rapidity, but affording great heat, is called "steam coal," from its use in furnishing the supplies of steam

Hosted by Google

vessels taking long voyages. The middle part of the South Wales coal-field (the western is bituminous), and a part of the Newcastle field recently worked, contain excellent coal of this character.

Anthracite coal is very hard and glossy, not soiling the fingers. It is almost pure carbon, containing but a very small proportion of gaseous products. It burns with a very feeble flame, but gives an intense heat. From its comparative difficulty of combustion it was formerly but little used, but by the introduction of the hot air blast and other improvements in furnaces, it can be made available for many manufacturing processes, particularly that of the preparation of iron, for which it is now extensively used in Wales (the eastern part of the coal-field being anthracite) and the United States.

Notwithstanding the enormous consumption of this important fuel, the supply will, perhaps, *never* be exhausted. Immense areas in the New World must be added to the still profusely abundant districts of the Old. The coal area of Great Britain and Ireland is about 9,000 square miles, that of the rest of Europe about the same or rather less; and to known deposits in Asia, South America, Australia, and Africa, must be added no fewer than 150,000 square miles in the United States and Canada.

Many bituminous substances are produced in vegetable matter during its conversion into coal; the chief of these are naphtha, petroleum, and asphalte, which are all hydro-carbons of varying proportions, and of an inflammable nature. The bituminous substances are widely distributed, especially in the tropical and sub-tropical regions—a circumstance which evidently indicates that the substances are due to extensively operating natural causes, and not, as usually supposed, to the accidental combination of special agencies.

The modes of occurrence of asphaltic deposits seem referable to three principal divisions. 1. In the rocks of igneous origin; this is the case in Cuba, and at Mount

Hosted by Google

Lebanon. 2. In stratified rocks of the Palæozoic and Mesozoic epochs, usually disseminated in a granular form throughout the entire stratum, or issuing from the soil, or exuding from fissures in the rocks, in the form of springs of petroleum, naphtha, &c. 3. In rocks of Tertiary age usually accompanied by lignite or brown coal. These are the most abundant sources of asphaltic substances, and include those of Pegu, Trinidad, &c.

Naphtha is a transparent and nearly colourless fluid, burning with a copious flame and strong odour, and leaving no residuum.

Petroleum is dark-coloured, and thicker than common tar. It rises in immense quantities from some of our coal beds, and impregnates the earth so as to form springs and wells. Petroleum springs contain a mixture of petroleum and the various substances allied to it: they occur in abundance in Modena and Parma, Italy, Persia, Canada, United States, &c., but the most powerful are those in the province of Pegu in the Birman Empire. In many parts of the world petroleum is now the most abundant source of photogen and paraffin. The petroleum or rock oil of the United States is refined for illuminating purposes, while in the crude state it is a good lubricant.

Bitumen, or *Asphalte*, is an inspissated mineral oil, of a dark brown, or black colour, with a strong odour of tar; the most valuable is hard, brittle, of a brilliant lustre, and eminently conchoidal fracture; a variety occurs of the consistency of jelly, and bearing some resemblance to soft india-rubber. It is very abundant on the shores of the Dead Sea, occupies the so-called pitch-lake in Trinidad, and occurs in Cuba, Peru, Mexico, Ionian Isles, Portugal, &c.

The Rangoon tar or Burmese naphtha, is distilled from a number of volatile hydro-carbons, chiefly used as lamp fuels; those known as Sherwoodole and Belmontine, have considerable detergent power, removing stains from silk without impairing delicate colours.

Hosted by Google

Beds of limestone and clay occur impregnated with bitumen, and from such paraffin is distilled in Britain, Germany, France, Austria, &c.

The annual produce of the principal coal districts of the globe, according to the latest returns, may be stated as follows:—

	TONS.		TONS.
Britain	101,620,000	Spain	400,000
Zollverein (with lignite)	25,000,000	Sweden	230,000
United States ...	16,472,000	India	370,000
France	11,000,000	Australia	450,000
Belgium	4,000,000	China	100,000
Austria	2,270,000	Nova Scotia...	651,300

OTHER BITUMINOUS SUBSTANCES.

Jet, so much prized in the manufacture of ornaments for its intense blackness, its lightness, and its beautiful polish, is a variety of lignite highly bituminised and free from earthy impurities, and resembles Cannel coal, but it is blacker, and has a more brilliant lustre. It occurs in the Upper Lias of Whitby, in which it is very abundant, in Languedoc, Asturias, the Alps, Gallicia, and Massachusetts. The value of the jet manufacture at Whitby is about £20,000 per annum.

Amber is a fossil resin, the origin of which has been traced to coniferous trees, and is found in alluvial gravels. It occurs, too, in the Cretaceous marls of France and Germany. It is procured from Prussia, the shores of the Baltic, the Adriatic and Sicilian shores, and from Japan, Madagascar, and the Philippine Islands.

Gum Copal is a semi-fossilised gum found in a sandy soil in the hilly districts all along the coasts of Angola, the total yearly export of which from all the districts of Angola is estimated at 2,000,000 lbs. A gum copal is obtained under similar conditions from Sierra Leone, and Zanzibar; the origin of which, as well as that of Angola, is still unknown.

Hosted by Google

Some copal resins are exudations from living trees, as that furnished by *Guibortia copallifera* of Sierra Leone, and others.

CALCAREOUS* SUBSTANCES.

The metal *calcium* very readily oxidises and forms lime, which easily enters into combination with carbonic acid, forming carbonate of lime—the base of limestone, chalk, marble, and calc-spar—and with sulphuric acid and water to form gypsum. Carbonate of lime in its various forms is a most abundant substance, and of the most extensive use, whether in its native condition as stone for building, paving, statuary, and smelting, or in its preparations—mortars and cements, in glass-making, leather-dressing, bleaching, agriculture, and medicine.

Common limestone is found in almost every geological formation; compact, and often crystalline in the older rocks, but generally loose and more earthy in the newer. It is abundant in nearly all countries, in varying qualities and degrees of adaptation to its numerous uses. In England it chiefly occurs in the rocks of the Devonian and Carboniferous series—Mountain Limestone especially—and in the Liassic and Oolitic systems. The dolomite or magnesian limestone belongs to the Permian group of rocks. The best kinds of limestone for building are those of Portland, Bath, Box, and Corsham, all of which are Oolitic, and the magnesian limestone of Notts and Yorkshire. The Oolite of Bavaria furnishes a very fine lithographic stone; these stones are also supplied from older rocks in Canada, and from France, Greece, and Portugal.

Of ornamental limestones those of South Devon are extensively worked. Some interesting varieties of the red, grey, and variegated marbles (so-called) are obtained near Torquay. Many blocks are almost entirely formed of fossil corals, and known as *madrepore* marbles. The Carboniferous

* That is, having the nature of limestone.

Hosted by Google

rocks of Derbyshire are rich in ornamental limestones, the chief varieties of which are the *entrochal* or *encrinital* marble, *productal* marble, and *black* marble. The former of the first two is built up of the stony fragments of stone-lilies (*Encrinites*), whilst the latter is composed almost entirely of shells of the genus *Producta*. Other marbles of a like character are obtained in Staffordshire, Somersetshire, and Ireland. The Purbeck and Petworth marbles are limestones charged with the fossil shell *Paludina*, and hence are sometimes called paludinal marbles; they belong to the Purbeck and Wealden series respectively, and were formerly employed extensively in ecclesiastical architecture.

The true marbles are altered limestones or dolomites. The finest is the pure white or statuary marble; others are red or yellow in colour, and either pure or streaked. They are firm in texture, finely grained, and susceptible of a beautiful polish; hence their use for ornamental purposes. Italy is pre-eminently a marble-producing country, to which fact must be ascribed the splendour of her palaces and other public and private structures, in which not only the architectural ornaments, but frequently, as in the case of the cathedral at Milan, the entire edifice is built of the finest marble. Italy has of late years produced an average of 250,000 tons per annum of statuary marble. The best white marble is now obtained from Carrara, quarried in the Apennines where they approach the Mediterranean. India, Sicily, Spain, Ireland, the United States, and other countries also furnish it.

Coral limestone belongs to this group of mineral products. It is a recent formation; and the rock is sometimes used as a building stone in the South Sea Islands. Great numbers of these islands, as well as numerous others in the Indian Ocean, are themselves natural coral structures. Coral reefs are abundant in tropical seas, in the North Atlantic, and the Pacific and Indian Oceans.

Marl, a mixture of clay with carbonate of lime, occurs

Hosted by Google

as clay-marl, marl-clay, and shelly-marl. It is procured from valleys which have formed the beds of lakes, and from the neighbourhood of existing lakes, and is useful as a manure. Calcareous sand, formed chiefly of crushed shells, and found on ancient and modern beaches, is also used in agriculture. Of such sand, 8,000,000 cubic feet are annually removed from the Cornish coast into the interior of the country. Some of the shelly deposits of the Crag formations, in the east of England, are similarly used.

Gypsum is a very valuable mineral, occurring chiefly in the New Red Sandstone and in Tertiary deposits, but also among earlier rocks. It is abundant in England, Ireland, France, Canada, Nova Scotia, and in many other places. Gypsum forms the plaster of Paris, of such utility in building and modelling; crystallised, it is met with as *selenite*, *satin gypsum*, and *alabaster*. The use of this last, for statuary and ornamental work, dates from the remotest times of Etruscan art. Statuary alabaster is obtained from the Miocene and Pliocene strata in Tuscany and in Egypt.

Limes, stuccoes, and cements, so indispensable in all building operations, are obtained from various carbonates. Pure carbonates make rich limes, which are such as set only in dry air; impure ones (with mixtures of clay) yield hydraulic limes, which possess the valuable property of setting in moist air, and even under water. The septaria or calcareous nodules in London clay, at Sheppey, those procured at Harwich, the cement stones of the Lias at Whitby, and of the Speeton Clay of Yorkshire, the Lower Lias limestone, &c., furnish suitable limestone for hydraulic cements.

SILICIOUS SUBSTANCES.

Another very important mineral substance is silica, which is a combination of oxygen with the metalloid silicium or silicon. The purest examples of silica are rock-crystal, quartz, and flint. The colourless crystals, especially the so-called Brazilian pebble, are much used for lenses.

Hosted by Google

Quartz, which, crystallised, constitutes several of the gems, is an important constituent of granitic rocks; and, in the form of sand, it is the principal ingredient in all sandstones. Quartz, well powdered, is combined with fine clays in the manufacture of porcelain in China, as flint is also in this country. Flints are irregular masses of nearly pure silica, occurring as nodules distributed in layers, in the Chalk formation especially. Reduced to powder, they enter into the composition of china, porcelain, and glass; and, whole, they furnish a rough building material.

Sandstones are of very various composition and of different degrees of hardness. They consist of silicious sands, often mixed with other substances, all cemented together by means of carbonate of lime, oxide of iron, silica, or clay. They are of all geological ages, the oldest being usually the most compact. When hard and coarse-grained they are denominated grits. If pebbles very largely predominate, they are called conglomerates, and these are either pudding stones with rounded pebbles, or breccia with angular fragments. The extremely hard and schistose grits are very useful for flag-paving. The best qualities of these are supplied from Forfarshire and Caithness. Millstones are obtained from the Millstone Grit of Newcastle, from Yorkshire, Belgium, France (especially at La Ferté), and Wurtemburg. They are also made from a silicious limestone near Paris, and out of lava at Andernach. For building purposes, the finest sandstone is quarried at Craigleith and other localities in the Carboniferous formations of Scotland. Good stone is obtained from rocks of the same age in Durham, Yorkshire, Derbyshire, &c., and from Queen's County and other parts of Ireland.

Silicious sands are much in request in the arts, as in building for mortars, in moulding and casting, and in glass-making. The most valuable for the last-named purpose are procured from Senlis in France, from the Isle of Wight, Lynn Regis, Aylesbury, and Reigate. *Rottenstone*, found in

Hosted by Google

Derbyshire and elsewhere, is a decomposed silicious limestone, and is used for polishing. Bath brick, Tripoli powder, the polishing powder from Bilin, in Bohemia, the *Berg-mehl* of Sweden and America, and the French *tellurine*, are peculiar mealy forms of silica.

IGNEOUS AND METAMORPHIC ROCKS.

Granites, and their allied rocks, gneiss, mica-schist, and felstones, consist largely of silica. Their chief mineral constituents, are quartz, felspar, and mica (white, green, or black). Felspar is a silicate of alumina and potash, or, in the case of *albite*, the white felspar of Cornish granite, of alumina and soda. Mica is a silicate of lime and alumina or iron. Where hornblende, a dark green silicate of lime and magnesia, has taken the place of mica, the stone is called *syenite*. These rocks assume a structure termed porphyritic, that is, they are composed of crystals embedded in an amorphous matrix, and are highly valued for ornamental purposes. These latter, and white granite, are obtained from Cornwall and Devon, red and grey granites from Aberdeen and Peterhead, and a very hard and dark variety from Guernsey, the Malvern Hills, and Leicestershire. Granitic rocks are abundant in many parts of the world, Ireland, Norway and Sweden, India, and China among others; and Egypt is famed for its syenite and red porphyritic felstone. They furnish a durable and highly-polishable building material particularly well suited for bridges, quays, and monumental works. The coloured varieties are eminently adapted for ornamental purposes. *Mica* is often found in large crystals, which can be split up into plates and used as glass. This is the material known as Siberian glass, from the country whence it is supplied. *Talc* is a similar mineral, and is employed in the porcelain and crayon manufactures: it forms, besides, the French chalk. *Asbestos* is a fibrous variety of hornblende. It can be woven into a fire-proof cloth, and is also made available in open gas stoves.

Hosted by Google

Serpentine, so called from the supposed resemblance of the mineral to the skin of a serpent, is a silicate of magnesia with adventitious admixtures of lime, alumina, iron, chromium, &c.; and occurs as a rock or in association with other minerals constituting rock masses. The west of Mayo and Galway are remarkable for their serpentine rocks, which afford the beautiful variegated green and white varieties worked into pilasters, columns, &c. Serpentines and serpentine limestones are also quarried in Cornwall, the Shetlands, Canada, United States, Italy, &c.

Basaltic and kindred rocks — greenstone, whinstone, and trap—are intrusive rocks, for the most part felspathic. Some of these are well adapted for building, but their great use is for paving and macadamising roads, for which purposes they are unrivalled. The columnar structure of basalt is in some places taken advantage of for the construction of stone posts and window-sills. These rocks are abundant in Scotland, and occur also in Ireland, Germany, and Nova Scotia.

Lava, a volcanic production, is often similar to trap, and equally useful. It occurs in recent and extinct volcanic districts. *Obsidian*, a volcanic glass, usually black, and somewhat resembling the slag of a glass furnace, is found in Mexico, Central America, Peru, Iceland, &c. *Pumice stone*, a well-known, porous, and extremely light stone, used for polishing, &c., and *Pozzuolano* and *trass*, silicious earths much used to mix with limes for hydraulic cements, are also volcanic productions, of which the chief mineral ingredients are augite and felspar. Pumice is quarried in the islands off the coast of Sicily. Pozzuolano and trass are obtained from Italy, France, Germany, and Scotland.

CLAYS AND ALLIED SUBSTANCES.

Clays, which are silicates of alumina more or less pure, occur in all formations from the firmest slates of the older rocks, and the loose shales of the Carboniferous and the

Hosted by Google

Secondary, to the plastic clays of the Tertiary and the alluvial deposits. They enter largely into the materials and processes of building, as slates, tiles (both for roofing, paving, and ornamental purposes), and bricks; into the manufacture of pottery of all sorts, terra-cotta, and many other useful applications. The common clay, so abundantly diffused over the earth's surface, and chiefly distinguished into three varieties—yellow, brown, and blue—furnishes material for the builder and the maker of the common pottery wares. China and porcelain are made from the fine clays called *kaolin* and *petuntse*, which are almost pure, and are due to the decomposition of the felspars of granitic rocks, the felspar containing soda being especially liable to disintegration. These clays are found in Cornwall, Devon, France, Belgium, and Germany, but can also be artificially prepared. *Pipe clay* is a white, pure variety, with an excess of silica. It is obtained from Poole and Purbeck. *Fire* or refractory clays used in the manufactory of fire bricks, retorts, and crucibles, contain a preponderance of silica over alumina, and occur chiefly in the Carboniferous strata. In England the Stourbridge clay is famous for these purposes. Belgium, and Siegburg in Germany, also furnish fine clays. Others, however, sufficiently pure, can be made available to some extent by the addition of silicious sand. *Fuller's earth* is a very useful clayey substance, having in its composition a large proportion of silica and a quantity of water. It is employed in the preparation of wool, and is abundantly met with in Surrey, Buckingham, Hampshire, Gloucestershire, and Bedford. The *ochres*, chiefly red and yellow, are mixtures of clay and oxide of iron. They are used in the manufacture of colours, and are obtained in the neighbourhood of Oxford, in Fife, in Antrim, Italy, and other places.

Slates, from their natural cleavage and their great durability, are of extreme utility for a variety of purposes, chiefly roofing, the construction of cisterns, and the manufacture

Hosted by Google

of school slates and pencils. The best are those which are hardest and finest in grain. Besides the common colour, there are green, purple, and grey slates. The laminæ are of different thicknesses, and are used accordingly. Slates are quarried chiefly from rocks of ancient date (Silurian and Cambrian), and are abundantly supplied from Penrhyn, Llanberis, Festiniog, and other parts of Wales, as well as from Cornwall, Devonshire, Westmoreland, Scotland, Ireland, France, Belgium, Germany, and Asia.

Hone stones, of which there are many varieties, are slaty stones which are used in straight pieces for sharpening tools after they have been ground on grindstones. The most important varieties are the following :—Norway ragstone, the coarsest variety, imported in large quantities from Norway; Charnwood Forest stone, one of the best substitutes for the Turkey oil stone, much in request by joiners and others, and obtained from Charnwood Forest, Leicestershire; Turkey oil stone, of which there are two varieties, white and black, the latter being the harder, surpassing every other oil stone, used by the engraver, and obtained from the interior of Asia Minor; Ayr stone; snake stone; Scotch stone, used especially for polishing copperplate; Welsh oil stone, second only to the Charnwood Forest stone, and obtained at Llyn Idwall, near Snowdon, whence is also obtained the "cutler's green stone;" and the German razor hone, derived from a yellow band in the blue slates of the neighbourhood of Ratisbon.

EARTHS OF SODIUM, POTASSIUM, BORON, SULPHUR, ETC.

The elements, the combinations of which we are about to speak, do not, for the most part, occur naturally in their simple state, but their compounds, especially those of sodium, potassium, and sulphur (which is also native) are numerous, abundant, and valuable.

Common Salt—chloride of sodium—is an extremely abun-

Hosted by Google

dant and quite an indispensable commodity. It exists in sea-water and salt lakes, in the proportions of from 3 to 4 per cent., or even more in some of the lakes, and can be extracted by evaporation. It occurs in a much larger proportion in many brine-springs connected with geological deposits of salt, but these deposits themselves form now by far the best sources of supply. Rock salt is obtained in England principally from the mines of Cheshire, and also near Belfast; culinary salt is manufactured in large quantities in Cheshire and Worcestershire from brine springs; in both cases, the salt is derived from the Keuper marls of the New Red Sandstone System, in which it occurs in basin-shaped deposits, and is arranged in wedge-shaped masses. Salt beds occur in rocks of various ages; those of Nova Scotia in the Carboniferous System, the rock salt of Ireland, England, and Prussian Saxony in the Keuper formation, that of the Carpathian Alps in the Upper Oolite, that of Poland and the Pyrenees in the Cretaceous series, and that of Pisa and Cuba in the Miocene rocks. Beds of salt occur also in China, and many districts of North America. Some of the salt mines of Europe furnish perhaps the most stupendous examples of mining industry. Salt for domestic purposes is refined from the more or less impure native product, and from it also common soda—carbonate of soda—(formerly made, like barilla, from the ashes of sea-weeds, &c.) is manufactured on an immense scale. Chlorine for bleaching and disinfecting purposes is also very largely supplied from the same source. Many parts of the earth being deficient in salt, it is an important article of commerce, and 600,000 tons are annually exported from this country, the yearly produce of which exceeds one and a half millions of tons.

The *Alums*, already alluded to under the head of aluminium, are important compounds of sulphate of alumina with sulphate of potash, or soda, or ammonia, potash being the most common. Alum occurs native to a small extent,

Hosted by Google

but from its great value in the arts, especially in dyeing and calico printing, it is manufactured on a large scale. One process is to treat clay with sulphuric acid, by which a sulphate of alumina is formed, to which potash, soda, or ammonia is added, and the resulting crystallised salt is accordingly either a potash, soda, or ammonia alum. Alum is also made from *alum slate* or *shale;* this substance contains alumina, protoxide of iron, a trace of potash, and iron pyrites dispersed through it. This pyritous shale, on exposure to the atmosphere undergoes decomposition, which is accelerated by the manufacturer, who, availing himself of the carbonaceous character of the shale, applies fire to the alum shale heap. The iron pyrites is changed into sulphate of iron, which forms, with the alumina, a double sulphate of iron and alumina; this is subsequently purified by evaporation, and by the addition of potash the salt is rendered crystallisable. Glasgow, Whitby, and Newcastle are the chief localities of alum manufacture in this country. The best alums are those prepared in Asia Minor and Italy, exported from Smyrna in the former country, and supplied by the latter under the name of Roman alum. China produces a considerable quantity, and Tuscany an average of 7,000 tons per annum.

Natron, a native sesquicarbonate of soda called *trona*, and mineral soda, is found in sandy soils in Egypt, Mexico, Hungary, &c. Large quantities are collected from the lakes of Sukena in Africa, and chiefly used for native consumption.

Borax, an important article, very useful in chemistry and the arts, is a compound of boracic acid and soda. It occurs in the waters of some lakes in Thibet and Persia, and is imported in an impure state, as *tincal*, from the East Indies. Much, however, is manufactured from boracic acid obtained in a native state by the evaporation of the mineral waters from the extraordinary volcanic lagoons of Tuscany, and from *hayescine*, a borate of lime found in Peru. The annual

Hosted by Google

produce of boracic acid from Tuscany has of late years been about from 1,800 to 2,000 tons.

Saltpetre, nitre, or nitrate of potash, is a natural product occurring on the surface of the soil in some hot and dry countries. It can also be prepared artificially, as is done in France, Germany, and other places. The British supply comes chiefly from the East Indies to the amount of 18,000 tons annually; the annual importation from other sources is about 5,000 tons. Besides being the chief ingredient in gunpowder, it is largely used in chemistry, medicine, and the arts.

Nitrate of soda, or *cubic nitre*, is found native in immense quantities as a geological deposit in Northern Chili and Peru, and is probably abundant over the salt plains of the same continent. It is largely imported by this country, to the extent of 50,000 tons annually (value £500,000), and used in agriculture, and for many of the purposes to which saltpetre is applied.

Sulphate of baryta, or heavy spar, is a beautifully crystallised mineral, occurring in mineral veins, in Cumberland, Westmoreland, Derbyshire (as cawk), Carinthia, Algiers, and Nova Scotia, and is a spurious substitute for white lead. The minerals *Celestine* (sulphate of strontia) and *Strontianite* (a carbonate of strontia) are used in the arts for the manufacture of the nitrate of strontia, which is employed for producing a red colour in fireworks. The salts of strontia are remarkable for the red colour which they impart to flame, whilst those of baryta give a green colour. *Fluor spar*, fluoride of calcium, is also a beautiful mineral, and important as the principal natural source of hydrofluoric acid and other combinations of fluorine. It occurs in the lead veins of Yorkshire and Derbyshire, and, from its rich colours, is used in the ornamental manufacture of tazza.

Sulphur is an element existing abundantly in various metallic and non-metallic compounds; but it also occurs native in quantities sufficient to render its extraction from its combina-

Hosted by Google

tions almost unnecessary; it is, however, separated for economic purposes from iron pyrites. It is found native in all volcanic regions, either as an efflorescence on the surface, or largely impregnated in earths. Sicily and Iceland possess it as a volcanic product, and from the former our chief supply, 50,000 tons annually, is obtained. Spain also supplies this substance. Sulphur is a very important article as an ingredient of gunpowder. Sulphuric acid (vitriol), so indispensable in the arts, together with other valuable sulphur compounds, has already been referred to. *Graphite, plumbago,* or *black lead,* although pure carbon, contains a variable quantity of iron up to a proportion of 5 per cent. It occurs in beds and embedded masses, in fissures in granitic and slate rocks, in nodules in greenstone, and, rarely, in mineral veins. This mineral, well known as the material from which the black-lead pencils of the finest quality are produced, is comparatively rare. It has been found on the right bank of the great river Tungouska, in a country previously little known. In the depths of pine-forests, and at the level of the waters of the wild Tunbusi, torn and abraded by the ice, one continuous mass of graphite has also been traced, 3,000 yards or more in length, with an ascertained depth of thirty yards. The famous mine of Borrowdale is almost exhausted. Considerable quantities are, however, procured from Ceylon (3,547 tons), and Austria (660 tons), as well as some from Spain, Mexico, Greenland, and the Cape Colony. Besides its common uses, plumbago is of great utility in the manufacture of crucibles for metallurgical and chemical purposes.

Among mineral productions available as articles of utility and commerce, mention must not be omitted of some that are of great use in agriculture, especially in such farming as must be carried on in densely-peopled countries, where all qualities of soil must be brought under cultivation. In addition to the silica, alumina, and lime, which are the common chemical constituents of arable soils, there must be

Hosted by Google

a due supply of salts of potash, phosphoric acid, nitrogen, and some other ingredients. Organic remains, in the shape of natural vegetable decay, and of ordinary farm manures, supply these; but mineral manures are also highly valuable and much used. Limes, clays, sands, marls are all useful under certain circumstances. Saltpetre (nitrate of potash) is a valuable addition to soils requiring nitrogen, but it is costly. The cubic nitre already alluded to, exists, however, in great abundance, and is largely available for the same purpose. Phosphates of lime are used to furnish the phosphoric acid. The supply is now chiefly obtained from the small hard nodules of various sizes, composed, in part, of ancient organic remains—*coprolites*—which are found in the Crag of Suffolk, and in the Greensand at Farnham, Cambridge, Hitchin, Isle of Wight, Havre and other parts of France. Phosphatic nodules are also abundant in the Lias. Thousands of tons of these are annually raised, crushed, and, by the action of sulphuric acid, converted into superphosphates of lime; and they are, in this form, extensively employed for manure. Phosphate of lime is quarried in Spain, and at Sombrero, one of the West Indian Isles, and prepared for agricultural purposes.

PRECIOUS STONES.

Important mineral products, on account of their great intrinsic value, are precious stones; these occur in mineral veins, and, as is the case with some of the metals and their ores, in river sands and alluvial deposits brought down from metalliferous districts. Brazil, India, the Ural Mountains, and the mining districts in general, especially those of the older formations, furnish the chief supply. Precious stones are either carbonaceous, aluminous, or silicious. The *Diamond* is the only one consisting of carbon, and is well known as the hardest and most valuable gem. Diamonds are prized according to their purity and freedom from colour, or if coloured, according to the depth of the tint.

Hosted by Google

Besides their extensive use for ornamental purposes, they are, in the form of fragments, of much service in the arts—as in glass-cutting, watch-making, and diamond polishing. The aluminous gems comprise the *Sapphires;* the red sapphire, or oriental *Ruby*, next in value to the diamond; the blue, or true *Sapphire;* the green, or *Oriental Emerald;* and the yellow, or oriental *Topaz;* the *Corundum*, or adamantine spar, the hardest substance next to diamond, and employed for emery-powder; the rubies of various reds; the *Topaz* of various yellows; and the *Garnets*, of which the carbuncle is the choicest. The *Emerald*, of a beautiful green, and the *Beryl*—yellow, blue, or colourless—are compounds of silica, alumina, and glucina. The most valuable of the silicious gems are the *Amethyst*, of a purplish-violet hue; the *Cairngorm* stone, the *Opal*, *Sardonyx*, *Agate* (which is also employed as a burnisher), *Chalcedony*, *Carnelian*, and *Jasper*. The *Lapis-lazuli*, from which ultramarine used to be prepared, is a beautiful mineral, found in China, Persia, and Siberia. The *Turquoise* may be considered as a phosphate of alumina, lime, and silica, with iron and copper. The chief supply is drawn from the Peninsula of Sinai, which appears to have been the great mining district of the ancient Egyptians. The turquoises occur more or less in veins of sandstone.

Hosted by Google

Hosted by Google

APPENDIX.

VOCABULARY OF THE NAMES OF NATURAL PRODUCTIONS IN THE PRINCIPAL EUROPEAN AND ORIENTAL LANGUAGES.

Ags.	Anglo-Saxon.	*Hind.*	Hindoostanee.
Arab.	Arabic.	*It.*	Italian.
Bali.	Bali.	*Jav.*	Javanese.
Beng.	Bengali.	*Lat.*	Latin.
Chin.	Chinese.	*Mal.*	Malay.
Cing.	Cingalese.	*Pers.*	Persian.
Da.	Danish.	*P.*	Portuguese.
Du.	Dutch.	*R.*	Russian.
F.	French.	*Sans.*	Sanscrit.
G.	German.	*Sp.*	Spanish.
Gr.	Greek (Modern).	*Tam.*	Tamul.
Guz.	Guzurati.	*Turk.*	Turkish.

THE languages are arranged in the following order:—English, French, Italian, Spanish, Portuguese, German, Dutch, Danish, Swedish, Russian, Modern Greek, Arabic (with Turkish when given), Persian, Sanscrit, Hindoostanee (Guzurati and Bengali, when distinct), Tamul, Cinghalese, Malay, followed occasionally by Javanese, Bali, Chinese.*

In order to be useful in suggesting something of the history of the object, or the history of its diffusion, a few etymologic additions have been made, within parentheses, consisting of the (*Ags.*) Anglo-Saxon root of the English word, when such existed, and of the Latin, as being

* In the preparation of the following list, the author has to express his obligations to J. A. H. Murray, Esq., of the Philological Society, for contributions from the Slavonic and other languages, as well as for very valuable assistance rendered throughout. Several gentlemen, natives of different parts of Europe, have kindly revised the proof sheets as they issued from the press. He must thank particularly Messrs. Bölling, Bonorino, Donnay, Myer, A. Pompe, and H. van Overzee. For Oriental terms the author is greatly indebted to the work of A. Faulkner, Esq., Assistant-Commissioner of Customs, Bombay (1856).

Hosted by Google

often the source of the English name, and generally of those in the Romance languages. In the case of words that have come from remote sources by a circuitous route, this is compendiously indicated thus—*Greek* through *Latin*, *Arabic* through *Spanish*, &c. Articles of which the English name is directly from the Anglo-Saxon, may be assumed to have been known in this island before the tenth century. If the Anglo-Saxon form agrees with the other Teutonic languages, and is distinct from the Latin, it may be assumed that the object was known to our ancestors before they entered Britain, *e.g.*, gold, wheat, clover; if the Anglo-Saxon is a mere variant of the Latin, it may be assumed that the knowledge of the object was attained by our ancestors, in Britain, from Latin sources, *e.g.*, turnip, vinegar. The names of Eastern origin have come chiefly through three routes—first, those of which a knowledge was acquired by the ancient Greeks from the Arabs, Persians, or Indians, *e.g.*, sugar, galbanum; secondly, those of which a knowledge was communicated by the Arabs in Spain to the Spanish and Portuguese—a numerous class of productions—*e.g.*, saffron, turmeric, artichoke, orange; lastly, those taken directly, in the modern period, from Hindoostanee, Malay, Chinese, &c., *e.g.*, tea, rattan, banian, banana.

AGATE (*Lat.* achates; *Gr.* αχάτης).—*F.* agate; *It.*, *Sp.*, *P.* agata; *G.* Achat; *Du.* agaat; *Da.* agatsteen; *Sw.* agat; *Gr.* ἀχάτης; *R.* **агать**, aghát'; *Hind.*, *Guz.* akeek.

ALABASTER (*Gr.* αλάβαστρον).—*F.* albâtre; *It.*, *Sp.*, *P.* alabastro; *G.* Alabaster; *Du.* albast; *Da.* alabast; *Sw.* alabaster; *Gr.* ἀλάβαστρον; *R.* **алебастръ**, alebástr'; *Hind.* murmur.

ALCOHOL, SPIRIT OF WINE (*Arab.* al kohol).—*F.* alcool, esprit de vin; *It.* spirito di vino; *Sp.* alcohól (espiritu rectificado); *P.* alcohol; *G.* rectificirter Weingeist; *Du.*, *Da.* alcohol; *Da.* rectificeret Spiritus Vini; *Sw.* alkohol; *R.* **самый чистый спиртъ**, samyĭ tshīstyĭ sprīt.

ALKALI (*Arab.* al kali).—*F.* alcali, soude; *It.*, *Sp.*, *P.* alcali; *G.* Alkali, Laugensalz; *Du.* loogzout; *Da.* ludsalt; *Sw.* alkali, lutsalt; *Gr.* αλκάλιον; *R.* **щелокъ**, shtshelók; *Hind.*, *Guz.* khar.

ALMOND,-S (*Lat.* amygdalum, *from Gr.* αμύγδαλον).—*F.* amande,-s; *It.* mandorla,-e; *Sp.* almendra,-s; *P.* amendoa,-s; *G.* Mandel,-n; *Du.* amandel,-n; *Da.*, *Sw.* mandel; *Gr.* αμύγδαλον; *R.* **миндалина**, mīndálīna; *Arab.* louz; *Pers.*, *Hind.*, *Guz.* buddam; *Sans.* inghurdi; *Tam.* parsie vadomcotty; *Cing.* Waloo luway; *Mal.* louzan; *Jav.* kateping.

ALOES (*Gr.* αλοή, *through Lat.*).—*F.* aloès; *It.*, *Sp.*, *P.* aloe; *P.* azevre;

Hosted by Google

G., *Du.*, *Da.*, *Sw.* aloe ; *Gr.* αλοὴ ; *R.* **сабуръ**, sabúr ; *Arab.* mucibar ; *Per.* sibbir ; *Hind.* alia ; *Tam.* carriaboolum ; *Cing.* comarika ; *Mal.* uloo-watan.

ALUM (*Lat.* alumen).—*F.* alun ; *It.* allume ; *Sp.* alumbre ; *P.* pedra hume ; *G.* Alaun ; *Du.* aluin ; *Da.* allun ; *Sw.* alun ; *Gr.* στύψη, στύψις ; *R.* **квасцы**, kvastsý ; *Arab.* shebb ; *Pers.* zajbeluir ; *Hind.* phutkee, phutkurrie ; *Guz.* phutkee ; *Sans.* puttaki ; *Tam.* paddicarum ; *Cing.* chinakarum.

AMBER (*Arab.* anbar, *through Spanish ; Lat.* succinum.)—*F.* succin, ambre jaune ; *Sp.* ambar ; *P.* ambre, ambar ; *It.* ambra gialla ; *G.* Bernstein ; *Du.* barnsteen ; *Da.* rav ; *Sw.* bernsten ; *R.* **янтарь** yantár' ; *Arab.* kernulbheir ; *Pers.* karuba ; *Hind.* kepoor, umbir ; *Tam.* umbir ; *Cing.* ambra ; *Mal.* ambur.

AMBERGRIS.—*F.* ambre gris=grey amber ; *It.* ambracane, ambra-grisea ; *Sp.*, *P.* ambargris ; *G.* Ambra ; *Du.* ambergrijs ; *Da.*, *Sw.* ambra ; *Gr.* ἄμβρα ; *R.* **амбра**, ámbra ; *Arab.* anbar ; *Pers.* shahboi ; *Hind.* umber ; *Sans.* ambara ; *Tam.* min-umbir ; *Cing.* mussumbra ; *Mal.* anbar.

AMETHYST (*Lat.* amethystus, *from Gr.* ἀμέθυστος).—*F.* amethyste ; *It.*, *Sp.* amatista ; *P.* ametista ; *G.* Amethyst ; *Du.* amethist ; *Da.* amethyst ; *Sw.* ametist ; *Gr.* ἀμέθυστος ; *R.* **вишневый лалъ**, vïshnévyï lal ; **аметистъ**, ametíst.

AMMONIACUM, GUM AMMONIAC (*Gr.*, *through Lat.*).—*F.* gomme ammoniaque ; *It.*, *P.* gomma ammoniaco ; *Sp.* goma amoniaco ; *G.* Ammoniack ; *Du.*, *Da.*, *Sw.* ammoniak ; *Gr.* ἀμμονιακὸν ; *Arab.* feshook, ushek ; *Pers.* semnugh-bil-shereen ; *Hind.* astruck.

AMMONIAC, SAL. *See* Sal Ammoniac.

ANCHOVY.—*F.* anchois ; *It.* acciuga ; *Sp.* anchoa ; *P.* anchova ; *G.* Anschove ; *Du.* ansjovis ; *Da.* anchovis ; *Sw.* anjovis ; *Gr.* αντζόϊα ; *R.* **анчоусъ**, antshöúss.

ANISE SEED (*Lat.* anisum).—*F.* graines d'anis ; *It.* anice ; *Sp.*, *P.* anis ; *G.* Anis ; *Du.* anijs ; *Da.*, *Sw.* anis ; *R.* **анисъ**, aníss ; *Gr.* ἄνισον ; *Arab.* anison ; *Pers.* razyeaneh-roomie ; *Sans.* sataphuspha ; *Hind.* anise ; *Guz.* anisu ; *Tam.* sumbu ; *Mal.* jeeramanis ; *Jav.* mungfi, adis-manis.

ANTIMONY (*Gr.*, *through Lat.*).—*F.* antimoine ; *It.*, *Sp.*, *P.* antimonio ; *G.* Spiessglanz ; *Du.* spiesglas ; *Da.* spidsglans ; *Sw.* spetsglans ; *Gr.* αντιμόνιον ; *R.* **антимонія**, antimóniya ; *Arab.* ismud ; *Pers.* surmah ; *Sans.* sauvira ; *Hind.* ungen ; *Guz.* surmah ; *Tam.* anjana kaloo ; *Mal.* surmah.

APPLE (*Ags.* æppel ; *Lat.* malum, pomum).—*F.* pomme ; *It.* mela, pomo ; *Sp.* manzána ; *P.* maçāa ; *G.* Apfel ; *Du.* appel ; *Da.* æble ; *Sw.* äple ; *Gr.* μῆλον ; *R.* **яблоко**, yábloko.

Hosted by Google

APRICOT (*Lat.* arbor præcocia, *through Sp. and F.*)—*F.* abricot; *It.* albicocco; *Sp.* albaricóque, damasco; *P.* albricoque, damasco; *G.* Apricose; *Du.* abrikoos; *Da.*, *Sw.* apricos; *Gr.* βερίκοκον, καΐσιον; *R.* **курега**, kurégha.

ARNOTTO, ANNATO.—*F.* rocou; *It.* ariana; *Sp.* arellana, achiote; *P.* oriana; *G.* Orlean; *Du.* orleaan, rokoe; *Sw.* orleana.

ARRACK (*Hind.*).—*F.* arac, rack; *It.* arrac, araco; *Sp.* araca, aguardiente de azucar; *P.* araca; *G.*, *Sw.* arack, rack; *Du.*, *Da.* arak; *R.* **рака**, raká; *Hind.* arrack.

ARROW-ROOT (*Lat.* maranta). — *F.* herbe à la flèche; *Sp.* maranta; *G.* Pfeilwurz; *Du.* pijlkruid; *Da.* salep; *Hind.* tikhur; *Tam.* kooamaoo.

ARSENIC (*Gr.* ἀρσην, strong, having virtue).—*F.* arsénic; *It.*, *Sp.*, *P.* arsénico; *G.* Arsenik; *Du.* rottekruid; *Da.* arsenik; *Sw.* arsenik; *Gr.* αρσενικόν; *R.* **мышьякъ**, myshyáck; *Arab.* turabul halil; *Hind.* sunchya; *Tam.* vullay pashanum; *Mal.* wrongon.

ARTICHOKE (*Arab.*, *through Sp. and F.*).—*F.* artichaut; *It.* carciofo; *Sp.* alcachófa; *P.* alcachofra; *G.* Artischocke; *Du.* artisjok; *Da.* artiskok; *Sw.* ärtskocka; *Gr.* αγκινάρα; *R.* **артишокъ**, artishókk.

ASARABACCA (*Lat.* asarum).—*F.* assaret; *It.*, *Sp.* asarabacara, asaraca; *P.* asarabacara, assarabacca; *G.* Haselkraut; *Da.* hasselurt; *Sw.* hasselört; *R.* **асаронъ**, assarón; *Gr.* ἄσαρον; *Arab.* asaroon; *Sans.* oopana; *Hind.* tuckir; *Tam.* mootricunjayvie.

ASBESTUS (*Gr.*, α, not; σβεω, to consume).—*F.* asbeste, amianthe; *It.* amianto; *Sp.*, *P.* asbesto, amianto; *G.* Asbest; *Du.* steenvlas; *Da.* steenhör; *Sw.* asbest; *Gr.* αμιάντος, σμίγουσα; *R.* **каменный ленъ**, kámmenyĭ lyónn—*i.e.*, stone flax.

ASH (*Ags.* æsc; *Lat.* fraxinus).—*F.* frêne; *It.* frassino; *Sp.* fresno; *P.* freixo; *G.* Esche; *Du.* esschen-boom; *Da.* aske-træ; *Sw.* ask-träd; *Gr.* φράξος; *R.* **ясень**, yassen'.

ASPARAGUS (*Lat.*).—*F.* asperge; *It.* aspárago; *Sp.* esparrago; *P.* espargo; *G.* Spargel; *Du.* aspergie; *Da.* asparges; *Sw.* sparris; *Gr.* σπαράγγιον, ἀσπάραγος; *R.* **холодецъ**, cholodéts, **спаржа**, sparzha.

ASPHALTUM (*Gr.*, *through Lat.*).—*F.* asphalte; *It.*, *Sp.* asfalto; *P.* asphalto; *G.* Judenpech, Bergpech; *Du.* jodenlijm; *Da.*, *Sw.* asphalt; *Gr.* ἄσφαλτος; *R.* **горная смола**, ghórnaya smolá.

ASS (*Ags.* assa, asal, *from Lat.* asinus).—*F.* âne; *It.* asino; *Sp.* asno; *P.* asno, burro; *G.* Esel; *Du.* ezel; *Da.* asen, æsel; *Sw.* åsna; *Gr.* ὄνος, γαΐδαρος; *R.* **оселъ**, ossyóll.

ASSAFŒTIDA (*Lat.*).—*F.* asafœtida; *It.* assafetida; *Sp.* asafetida; *P.* assafetida; *G.* Teufelsdreck; *Du.* duivelsdrek; *Da.* dyvels-

Hosted by Google

dræk ; *Sw.* dyfvelsträk ; *Arab.* hilteeth ; *Pers.* ungoozeh ; *Sans.* hinga, hingu; *Hind.* hing ; *Tam.* perungyum ; *Mal.* angu.

BACON.—*F.* lard ; *It.* lardo ; *Sp.* tocino ; *P.* toucinho ; *G.* Speck *Du.* spek ; *Da.* flæsk ; *Sw.* fläsk ; *Gr.* **λαρδίον** ; *R.* **ветчина,** vetshiná.

BALLAST (*Da., through Du.*).—*F.* lest ; *It.* stiva, zavorra ; *Sp.* lastre ; *P.* lastro ; *G., Du.* Ballast ; *Da.* ballast, baglast (*i.e.*, back-load) ; *Sw.* barlast (*i.e.*, bare-load) ; *Gr.* **σαβοῦρα** ; *R.* **балластъ,** balást ; *Hind.* neerum.

BALSAM (*Lat.* balsamum, *from Gr.* **βαλσαμον.**)—*F.* baume ; *It., Sp., P.* bálsamo ; *G.* Balsam ; *Du.* balsem ; *Da.* balsam ; *Sw.* balsam ; *Gr.* **βάλσαμον** ; *R.* **мазъ,** mazz, **бальзамъ,** bal'zam.

BAMBOO (*Lat.* bambusa). — *Fr.* bambou ; *It.* bambu ; *Sp.* bamboa ; *P.* bambu ; *G.* Bambus ; *Du.* bamboes ; *Da.* bambus-rör ; *Sw.* bamburör ; *R.* **бамбукъ,** bambúk, **индійская трость,** indíĭskaya trost' ; *Hind.* bumboo ; *Mal.* buluh ; *Jav.* preng.

BANANA.—*F.* banane ; *It., Sp., P.* banana ; *Sp.* plátano ; *G.* Paradiesfeige, Pisang ; *Du.* pisangboom ; *Da.* bananer, pisang ; *Sw.* bananas träd ; *Sans.* kudali ; *Hind,* kayla ; *Tam.* valiepullum ; *Cing.* kehl-kang ; *Mal.* pesang ; *Jav.* gadang.

BARILLA (*Sp.*).—*F.* barille ; *It., Sp.* barilla ; *P.* barrilha ; *G.* Spanische Soda ; *Du.* barillaloogzout ; *Da.* barilla, Spansk soda ; *R.* **соцянка,** sotsyanka ; *Arab.* kali ; *Hind.* sajeekhar.

BARK (*Da., Ags.* rind ; *Lat.* cortex).—F. écorce ; *It.* scorza ; *Sp.* corteza ; *P.* casca ; *G.* Rinde ; *Du.* schors ; *Da.* bark ; *Sw.* bark ; *Gr.* **φλοῦδα** ; *R.* **коря,** korya ; *Arab.* kusher ; *Hind.* chal.

BARLEY (*Ags.* bere ; *Lat.* hordeum).—*F.* orge ; *It.* orzo ; *Sp.* cebada ; *P.* cevada ; *G.* Gerste ; *Du.* gerst ; *Da.* byg ; *Sw.* bjugg ; *Gr.* **κριθάριον** ; *R.* **ячмень,** yatshmén' ; *Arab.* shair, dhourra ; *Pers., Hind., Guz.* jow.

BAY, or LAUREL (*Gr.* **βαιον,** a palm-branch ?).—*F.* laurier ; *It.* lauro ; laurél ; *P.* loureiro ; *G.* Lorbeer ; *Du.* laurier ; *Da.* laurbærtræ ; *Sw.* lager (träd) ; *Gr.* **δάφνη** ; *R.* **лавръ,** lavr.

BEAN (*Ags.* bean).—*Lat.* faba ; *F.* fève ; *It.* fava ; *Sp.* haba ; *P.* fava, *G.* Bohne ; *Du.* boon ; *Da.* bönne ; *Sw.* böna ; *Gr.* **κουκίον** ; *R.* **бобъ,** bobb.

BEECH (*Ags.* béce ; *Lat.* fagus).—*F.* hêtre ; *It.* faggio ; *Sp.* haya ; *P.* faia ; *G.* Buche ; *Du.* beukenboom ; *Da.* bögetræ ; *Sw.* bokträd ; *Gr.* **'οξύα** ; *R.* **букъ,** buk.

BEEF (*Lat.* bos, bovis, *ox*).—*F.* bœuf ; *It.* vaccina, manzo ; *Sp., P.* vaca ; *G.* Rindfleisch ; *Du.* rundfleesch ; *Da.* oxekjöd ; *Sw.* oxkött ; *Gr.* **βόδιον κρέας** ; *R.* **говядина,** ghovyádīna.

BEER (*Ags.* beor, *from* bere, barley ; *Lat.* cerevisia).—*F.* bière ; *It.*

Hosted by Google

birra ; *Sp.* cerveza ; *P.* cerveja ; *G.* Bier ; *Du.* bier ; *Da.*, *Sw.* öl ; *Gr.* ξύθος, μπίβα ; *R.* **пиво**, pīvo.

BEET (*Lat.* beta).—*F.* betterave ; *It.* bietola ; *Sp.* acelga ; *P.* acelgas ; *G.* Beete ; *Du.* biet ; *Da.* bede ; *Sw.* beta ; *R.* **свекла**, svekla.

BENZOIN, BENJAMIN.—*F.* benjoin ; *It.* bengivi ; *Sp.* benjuì, menjuì ; *P.* beijoim ; *G.* Benzoe ; *Du.* benzoë ; *Da.*, *Sw.* benzoe ; *R.* **росной ладонъ**, rosnoĭ ladónn ; *Arab.*, *Pers.*, *Hind.*, *Guz.* luban ; *Sans.* devadhupa ; *Cing.* caloowell ; *Mal.* cominyan ; *Jav.* menjan.

BERRY (*Ags.* berige, what a tree *bears ; Lat.* bacca).—*F.* baie ; *It.* bacca ; *Sp.* baya ; *P.* baga ; *G.* Beere ; *Du.* bes ; *Da.* bær ; *Sw.* bär ; *Gr.* κούκουτζον ; *R.* **ягоды**, yághody.

BERYL (*Gr.*, *through Lat.*).—*F.* béril ; *It.* berillo ; *Sp.* beril ; *P.* berillo ; *G.* Beryll ; *Du.* berilsteen ; *Da.* beryl-steen ; *Sw.* beryl-sten ; *R.* **бериллъ**, beríll.

BETEL.—*F.* bétel ; *Sp.* betél ; *P.* bethel, betere ; *G.*, *Du.* betel ; *Arab.* tambool ; *Pers.* burgi-tambul ; *Sans.* tambuli ; *Hind.* pan ; *Tam.* vettilei ; *Mal.* sireh.

BIRCH (*Ags.* beorc, byrke ; *Lat.* betula).—*F.* bouleau ; *It.* scopa ; *Sp.* abedul ; *P.* vidoeiro ; *G.* Birke ; *Du.* berk ; *Da.* birke-træ ; *Sw.* björk ; *Gr.* σημύδα ; *R.* **береза**, beréza.

BIRD-LIME (*Lat.* viscus).—*F.* glu ; *It.* vischio ; *Sp.* liga ; *P.* visco ; *G.* Vogel-leim ; *Du.* vogellijm ; *Da.* fugleliim ; *Sw.* fogellim ; *Gr.* ἰξός ; *R.* **птичій клей**, ptītshiĭ kleĭ.

BISMUTH (*Germ.*).—*F.* bismuth ; *It.*, *Sp.* bismuto ; *P.* bismuth, marcasita ; *G.* Wissmuth ; *Du.*, *Da.* bismuth ; *Sw.* bismut ; *R.* **висмутъ**, vīsmut.

BITUMEN (*Lat.*).—*F.*, *It.* bitume ; *Sp.* betun ; *P.* betume ; *G.* Erd-pech, Erdharz ; *Du.* jodenlijm ; *Da.* jordbeg ; *Sw.* jordbeck ; *R.* **горная смола**, ghornaya smolá ; *Pers.* nift-i-roomie ; *Hind.* nift-roomie.

BONE (*Ags.* bán ; *Lat.* os, ossa).—*F.* os ; *It.* osso ; *Sp.* hueso ; *P.* osso ; *G.* Knochen ; *Du.* been ; *Da.* been ; *Sw.* ben ; *Gr.* κόκκαλον ὀστέον ; *R.* **кость**, kost' ; *Pers.* istakhan ; *Hind.* huddee.

BORAX (*Lat.*).—*F.* borax ; *It.* borrace ; *Sp.* borrax ; *P.* borax, tincal ; *G.*, *Du.*, *Da.*, *Sw.* borax ; *R.* **бура**, búra ; *Arab.* buruk ; *Pers.* tunkar ; *Sans.* tunkanna ; *Hind.* tunkun-khar, kuddiakhar ; *Tam.* velligarum, vengarum ; *Cing.* lansipuscara ; *Mal.* patterie, piger ; *Jav.* piger.

BOX (*Ags.* bux, *from Lat.* buxus).—*F.* buis ; *It.* bosso ; *Sp.* box ; *P.* buxo ; *G.* Buchsbaum ; *Du.* boksboom ; *Da.* buxbom-træ ; *Sw.* buxbom ; *R.* **буксъ**, buks.

BRASS (*Ags.* bræs, *from* bredan, *to bend*).—*Lat.* æs ; *F.* airain, cuivre

Hosted by Google

jaune; *It.* ottone, rame; *Sp.* laton; *P.* latão; *G.* Messing, Erz; *Du.* geel koper; *Da., Sw.* messing; *R.* **зеленая мѣдь**, zelénaya myêd'; *Hind.* peetul.

BRAZILWOOD.—*F.* bois de brésil; *It.* legno del Brasile, verzino; *Sp.* madera, palo del Bresil; *P.* pao Brasil, pao de Rainha; *G.* Brasilienholz; *Du.* Brasilienhout; *Da.* Brasilietræ; *Sw.* bresilja träd.

BRICK (*F.*).—*F.* brique; *It.* mattone; *Sp.* ladrillo; *P.* tijolo; *G.* Backstein; *Du.* baksteen; *Da.* muursteen; *Sw.* tegelsten; *Gr.* **τοῦβλον**; *R.* **кирпичъ**, kīrpítsh; *Hind.* eat.

BRISTLES (*Ags.* bristl; *Lat.* seta).—*F.* soies de cochon; *It.* setole; *Sp.* cerdas; *P.* sedas (de porco); *G.* Borsten; *Du.* borstels; *Da.* svinebörster; *Sw.* svinborst; *Gr.* **γουρουνότριχα**; *R.* **щетины**, shtshetīny.

BRONZE (*F.*).—*F.* bronze; *It.* bronzo; *Sp.* bronce; *P.* bronze; *G.* Bronze; *Du.* brons; *Da.* bronce; *Sw.* brons; *R.* **бронза, желтая мѣдь**, bronza, zhéltaya myêd'.

BUCKWHEAT.—*F.* blé sarrasin, blé noir; *It.* grano nero, sarracino; *Sp.* trigo negro, sarraceno; *P.* trigo sarraceno; *G.* Buchweizen, Heidekorn; *Du.* boekweit; *Da.* boghvede; *Sw.* bokhvete; *R.* **гречиха**, ghretshīha.

BUTTER (*Ags.* butyre, *from Lat.* butyrum).—*F.* beurre; *It.* butirro; *Sp.* manteca; *P.* manteiga; *G.* Butter; *Du.* boter; *Da. Sw.* smör; *Gr.* **βούτυρον**; *R.* **масло**, maslo; *Hind.* muska, mucken.

CACAO, or COCOA (*Caribb.*).—*F.* cacao; *It.* caccao; *Sp., P.* cacáo; *G., Du.* Cacao; *Da., Sw.* kakao; *Gr.* **κάκαον**; *R.* **какао**, kakao.

CABBAGE (*corruption of Brassica* capitata *or* capitagium ?).—*F.* chou; *It.* cávolo; *Sp.* berza, col; *P.* couve, repolho; *G.* Kohl; *Du.* kool; *Da.* kaal; *Sw.* kål; *Gr.* **λάχανον**; *R.* **капуста**, kapústa.

CALABASH.—*F.* calebasse; *It.* zucca; *Sp.* calabaza; *P.* calabaça; *G.* Calabasse; *Du.* kalebas; *Da.* kalabas, flaskegræskar; *Sw.* kalebass; *R.* **горлянка**, ghorlyánka.

CALCEDONY (*Gr., through Lat., from* City of Chalcedon)—*F.* calcédoine; *It., Sp., P.* calcedonia; *G.* Chalcedonien; *Du.* chalcedon; *Da.* khalkedón; *Sw.* Kalcedon; *Gr.* **χαλκηδὼν**; *R.* **халкедонъ**, khalkedón; *Hind.* akeek.

CAMEL (*Heb., through Gr. and Lat.* Camelus).—*F.* chameau; *It.* cammello; *Sp.* camello; *P.* camelo; *G., Du., Da.* Kameel; *Sw.* kamel; *Gr.* **καμήλα**; *R.* **верблюдъ**, verblyúd.

CAMPHOR (*Sans., Gr., Lat.*).—*F.* camphre; *It.* cánfora; *Sp.* alcanfor; *P.* alcanfor, camphora; *G.* Kampfer; *Du.* kamfer; *Da.* campher; *Sw.* kamfer; *Gr.* **κάμφορα**; *R.* **камфора**, kámfora; *Arab., Pers.* kafoor; *Sans.* kapūr; *Hind., Guz.* kumfoor; *Tam.* carpoorum; *Cing.* capooroo; *Mal.* kaafur.

Hosted by Google

CANE (*Lat.* canna; *Gr.* **καννα**, *from Heb. and Arab.*).—*Fr.* canne; *It.* canna; *Sp.* caña; *P.* canna; *G.* Rohr; *Du.* rotting; *Da.* rör; *Sw.* rör; *Gr.* **κάλαμος**; *R.* **камышъ, трость,** kamysh, trost'; *Hind.* bhate; *Guz.* nathur.

CANTHARIDES (*Gr.* **κανθαρὶς**, *through Lat.*).—*F.* cantharide; *It.* cantaridi, canterelle; *Sp.* cantaridas; *P.* cantharidas; *G.* spanische Fliegen; *Du.* spaansche vliegen; *Da.* spanske fluer; *Sw.* spanska flugor; *Gr.* **κανθαρίδια**; *R.* **Шпанскія мухи,** Shpánskiä múkhi.

CAOUTCHOUC.—*See* India-rubber.

CAPERS (*Gr.*, *Lat.*)—*F.* câpre; *It.* cappero; *Sp.* alcaparro; *P.* alcaparra; *G.* Kaper; *Du.* Kapper; *Da.* kapers; *Sw.* kapris, capers; *Gr.* **κάπαρη**; *R.* **каперсы,** kápersy; *Arab.* kebbir.

CAPSICUM.—*F.* feuille de piment; *Sp.* pimiento; *P.* pimenta; *G.* spanischer Pfeffer; *Du.* spaansche peper; *Da.* Spansk peber; *Sw.* Spansk peppar; *Hind.*, *Guz.* mirchee; *Mal.* chubui; *Jav.* lombok.

CARAWAY (*Lat.* carum).—*F.*, *It.* carvi; *Sp.* alcaravea; *P.* caravea, chirivia; *G.* Feldkümmel; *Du.* karrewei; *Da.* dansk kummin; *Sw.* kummin; *Gr.* **κύμινον**; *R.* **киминъ,** kímín, **тминъ,** tmín.

CARDAMOMS.—*F.* cardamomes; *It.* cardamomi; *Sp.*, *P.* cardamomos; *G.* Kardamom; *Du.* kardamomen; *Da.* kardemomme; *Sw.* Kardemumma; *Gr.* **καρδάμωμοι**; *Arab.* ebil, heelbuya; *Pers.* kakelah-segar; *Hind.*, *Guz.* ealchee; *Tam.* yaydersie; *Cing.* ensal; *Mal.* capalaga; *Jav.* kapol.

CARROT (*Lat.* carota, *from Celtic*).—*F.* carotte; *It.* carota; *Sp.* zanahoria; *P.* cenoura; *G.* Möhre; *Du.* gele Wortel; *Da.* gulerod; *Sw.* morot; *Gr.* **δαῦκος**; *R.* **морковь,** morkóv'.

CASTOR (*Lat.* castor, *the beaver*).—*F.*, castoréum; *It.* castora; *Sp.*, *P.* castoreo; *G.* Bibergeil, Castor; *Du.* bevergeil; *Da.* bævergel; *Sw.* kastor, bäfwer-gall; *Gr.* **καστόρχιον**; *R.* **бобровая струя,** bobrovaya struyá; *Arab.* ashbutchegan; *Pers.* joond-bedushtar.

CASTOR-OIL (*Lat.* oleum Ricini.)—*F.* huile de Ricin; *Sp.* aceite de palma cristi; *P.* oleo de mamona, de ricino; *G.* Ricinus-öl; *Du.* ricinus-olie; *Da.* Amerikansk olie; *Hind.* errundee-ka-teil.

CATECHU, CUTCH.—*F.* cachou; *It.* catecu; *Sp.* tierra Japonica; *P.* catch; *G.* Katchu; *Hind.*, *Guz.* cutch, cuth, couth; *Mal.* gambir.

CAVIAR.—*F.* caviar; *It.* caviale; *Sp.* cabial; *P.* ovas escaladas; *G.* Kaviar; *Du.* kaviaar; *Da.* caviar; *Sw.* kaviar; *Gr.* **χαβιάριον**; *R.* **икра,** ïkrá.

CEDAR (*Lat.* cedrus, *from Greek*).—*F.* cèdre; *It.*, *Sp.*, *P.* cedro; *G.* Ceder; *Du.* ceder; *Da.* ceder-træ; *Sw.* ceder-träd; *Gr.* **κέδρος**; *R.* **кедръ** kedr.

Hosted by Google

CELERY.—*F.* céleri; *It.* selleri; *Sp.* apio; *P.* apio hortense; *G.* Sellerie; *Du.* selderij; *Da.*, *Sw.* selleri; *R.* **сельдерей**, sel'deréĭ.

CEMENT (*Lat.*).—*F.* ciment; *It.*, *Sp.* cimento; *F.* cemento; *G.*, *Du.*, *Da.*, *Sw.* Cement; *Gr.* **κόλλα, πετρόκολλα**; *R.* **клей**, kleĭ.

CHALK (*Ags.* ceale, cálc, *comp. Lat.* calx, *lime; Lat.* creta).—*F.* craie; *It.* creta, gesso; *Sp.* greda; *P.* greda; *G.* Kreide; *Du.* krijt; *Da.* kridt; *Sw.* krita; *Gr.* **κυμωλία**; *R.* **мѣлъ**, myêl; *Arab.* tyn-abyaz; *Hind.* kurroo; *Tam.* simie-chunamboo; *Mal.* capoor-engrees; *Cing.* ratta-hoonoo.

CHAMOMILE (*Lat.* chamomilla, *from Gr.* **χαμομίλλα**).—*F.* camomille; *It.* camomilla; *Sp.* manzanilla; *P.* macella; *G.*, *Du.*, *Da.* Kamille; *Sw.* kamillblomster; *Gr.* **χαμόμηλα**; *R.* **ромашка**, romáshka; *Arab.* ehdahkl-mirzie; *Pers.* babooneh-gow; *Hind.* baboone-kaphul; *Tam.* chamaindoo-poo.

CHARCOAL (cear-coal; *i.e.*, turned coal, coal turned or converted from something else).—*Lat.* carbo; *F.* charbon (de bois); *It.* carbone (di legna); *Sp.* carbon (de leña); *P.* carvão (de lenha); *G.* Holzkohle; *Du.* houtskool; *Da.* trækul; *Sw.* bränkol; *Gr.* **ξυλοκάρβουνον**; *R.* **дровяной уголь**, drovyánnoĭ ughol'; *Arab.* fuhm-chobie; *Pers.* zeghal-i-chobie; *Hind.* koo-e-la; *Tam.* adapoo-karrie; *Cing.* lippe-anghoroo.

CHEESE (*Ags.* cyse, cese; *Lat.* caseus).—*F.* fromage; *It.* formaggio, cacio; *Sp.* queso; *P.* queijo; *G.* Käse; *Du.* kaas; *Da.*, *Sw.* ost; *Gr.* **τυρίον**; *R.* **сыръ**, syrr; *Pers.*, *Hind.*, *Guz.* paneer.

CHERRY (*Lat.* cerasus; *Ags.* cirse).—*Fr.* cerise; *It.* ciriegia; *Sp.* cereza; *P.* cereja, jinja; *G.* Kirsche; *Du.* kers; *Da.* kirsebær; *Sw.* kersbär; *Gr.* **κέρασον**; *R.* **вишна**, vīshna.

CHESTNUT (*Lat.* castanea).—*F.* chataîgne; *It.* castagna; *Sp.* castaña; *P.* castanha; *G.* Kastanie; *Du.* kastanje; *Da.* castanie; *Sw.* kastanje; *Gr.* **κάστανον**; *R.* **каштанъ**, kashtánn.

CHICORY (*Lat.* cichorium; *Gr.* **κιχώριον**).—*F.* chicorée; *It.* cicorea; *Sp.* achicória; *P.* chicoria; *G.* Chicorie, Wegwart; *Du.* cichorei; *Da.* cicorie; *Sw.* cikorie; *Gr.* **πικραλίδα**; *R.* **цикорей**, tsikóreĭ.

CHINA ROOT.—*F.* esquine, squine; *Sp.* cocolmeca, raiz china; *P.* esquina; *G.* China-wurzel; *Du.* China-wortel; *Da.* China-rod; *Sw.* kina-rot; *R. Arab.* khusb-sinie; *Hind.* choob-cheenee; *Beng.* shook-china; *Tam.* Paringay-putty; *Cing.* China-alla.

CHOCOLATE (*F.*).—*F.* chocolat; *It.* cioccolato; *Sp.*, *P.* chocolate; *G.* Schokolate; *Du.*, *Da.* chocolade; *Sw.* choklad; *R.* **шоколадъ**, shokoládd.

CHRYSOLITE (*Lat.* chrysoli hus, *from* **χρυσόλιθος**, *gold-stone*, in allusion to colour).—*F.* chrysolithe; *It.*, *Sp.* crisólito; *P.* crysolita;

Hosted by Google

G. Chrysolith ; *Du.* chrysoliet ; *Da.* Krysolit ; *Sw.* krysolit ; *Gr.* χρυσόλιθος ; *R.* **златокамень**, zlatokamen'.

CHRYSOPRASE (*Lat.* chrysoprasus, *from Gr.* χρυσόπρασος).—*F.* chrysoprase ; *It.*, *Sp.* crisoprasio ; *P.* chrisopraso ; *G.* Chrysoprasus ; *Du.* chrysopraas ; *Da.* chrysopras ; *Sw.* krysopras ; *Gr.* χρυσόπρασος ; *R.* **хризопрасъ**, khrisopráss.

CIDER (*Fr.*)—*F.* cidre ; *It.* sidro ; *Sp.* sidra ; *P.* cidra ; *G.* Cider, Apfelwein ; *Du.* appeldrank ; *Da.* æblemost ; *Sw.* cider, äpelwin ; *Gr.* σίκερα ; *R.* **яблоневка**, yablonévka.

CINNABAR (*Arab.* zanjifrah ; *Gr.* κιννάβαρι ; *Lat.* cinnabari).—*F.* cinabre ; *It.* cinnabaro ; *Sp.*, *P.* cinabrio ; *G.* Zinnober ; *Du.* vermiljoen ; *Da.* cinnober ; *Sw.* cinober ; *Gr.* κολκιναβάριον ; *R.* **киноварь**, kinovár ; *Arab.* zunjefer ; *Pers.* shengherf ; *Sans.* inghulam ; *Hind.*, *Guz.* hingda, durdar ; *Tam.* enghilicum, shadilengum ; *Mal.* sedilengam.

CINNAMON (*Heb.*, *Arab.*, *Gr.*, *Lat.*).—*F.* cinnamome, cannelle ; *It.* cinnamomo, cannella ; *Sp.* canela ; *P.* canella, cinamomo ; *G.* Zimmt, Caneel ; *Du.*, *Da.* kaneel ; *Sw.* kanel ; *Gr.* κανέλλα, κιννάμωμον ; *R.* **корица**, korītsa ; *Arab.* darsini ; *Sans.* darasita ; *Pers.* dalchenee ; *Hind.* tuj ; *Tam.* carruwa puttay ; *Mal.* kaimanis ; *Cing.* kurundu.

CLAY (*Ags.* clæg—*i.e.*, that which clogs or cleaves ; *Lat.* argilla).—*F.* argile ; *It.* argilla ; *Sp.* arcilla ; *P.* barro ; *G.* Lehm, Thon ; *Du.* klei, leem ; *Da.* leer ; *Sw.* ler ; *Gr.* πηλός ; *R.* **глина**, ghlīna.

CLOVE (*from Lat.* clavis, *a nail*, in allusion to shape).—*F.* clou de girofle ; *Sp.* clavo ; *P.* cravos ; *G.* Krautnagel (= vegetable nails) ; *Du.* kruidnagel ; *Da.* nellike ; *Sw.* (krydd)neglika ; *R.* **гвоздика**, ghvozdīka ; *Gr.* καρυόφυλλον ; *Arab.* kerenful ; *Pers.* meykhek ; *Sans.* lavanga ; *Hind.* luvung ; *Tam.* craumboo ; *Cing.* warrala ; *Mal.* chankee ; *Jav.* woh-kayu-lawang ; *Bali*, buwahluvung ; *Chin.* theng-hio.

CLOVER (*Ags.* clæfre ; *Lat.* trifolium).—*F.* trèfle ; *It.* trifoglio ; *Sp.* treból ; *F.* trifolio ; *G.* Klee ; *Du.* klaver ; *Da.* klöver ; *Sw.* klöfwer ; *Gr.* τρίφυλλον ; *R.* **кашка**, kashka, **клеверъ**, klevérr.

COAL (*Ags.* cól ; *Lat.* carbo=charcoal).—*F.* charbon (de terre), Houille ; *It.* carbone (fossile) ; *Sp.* carbon (de piedra) ; *P.* carvão (de pedra) ; *G.* Kohle, Steinkohle ; *Du.* kool ; *Da.* kul ; *Sw.* kol, stenkol ; *Gr.* (πετρο)καρβουνον ; *R.* (**каменный**) **уголь**, (kámenniĭ)ughol' ; *Hind.*, *Guz.* welaety-kooela.

COBALT (*Ger.*).—*F.* cobalt ; *It.*, *Sp.*, *P.* cobalto ; *G.*, *Du.*, *Da.* Kobalt ; *Sw.* kobolt ; *R.* **кобальтъ**, kóbal't.

COCHINEAL (*Lat.* coccinellus, *dimin. of* coccineus, *from Gr.* κόκκος, scarlet). — *F.* cochenille ; *It.* coccineglia ; *Sp.* cochinilla ; *P.*

Hosted by Google

cochenilha ; *G.* Cochenille ; *Du.* konzenilje ; *Da.* cochenille ; *Sw.* kochenill ; *Gr.* κοκκινέλλα ; *R.* канцелярное сѣмя, kantselyárnoe syêma, кошениль, koshenille ; *Pers.*, *Hind.*, *Guz.* kermij ; *Tam.* cochineel poochie.

COCKLE (*Lat.* cochlea, *from Gr.* κοχλίας, a shell).—*F.* pétoncle ; *It.* conchiglia ; *Sp.* caracol de mar ; *P.* bribigão ; *G.* Herzmuschel ; *Du.* kammossel ; *Da.* musling ; *Sw.* mussla ; *G.* κογχύλιον ; *R.* гребенка, ghrebeönka.

COCO, or COCOA-NUT.—*Fr.* coco ; *It.* cocco ; *Sp.*, *P.* coco ; *G.* Cocos-(nuss) ; *Du.* kokos (noot) ; *Da.* cocos (nöd) ; *Sw.* kokos (nöt) ; *Gr.* κόκον, κοκοφόινιξ ; *R.* кокос(овый орѣх) kokós (ovyĭ oryêkh) ; *Arab.* nareel ; *Pers.* nargîl ; *Hind.*, *Guz.* nareel, narul ; *Sans.* narikela.

COD (*Lat.* gadus).—*F.* morue ; *It.* baccala, baccalare ; *Sp.* bacalao ; *P.* bacalhão ; *G.* Kabeljau ; *Du.* kabeljaauw ; *Da.* kabliau ; *Sw.* kabiljo ; *Gr.* γαδαρόψαρον, ὀνόψαρον ; *R.* треска, treska.

COFFEE (*from its native country*, Caffa, *a south-western province of Abyssinia*).—*Bot. Lat.* coffea ; *F.* café ; *It.* caffè ; *Sp.* café ; *P.* café ; *G.* Kaffee ; *Du.* koffij ; *Da.* caffe ; *Sw.* kaffe ; *Gr.* καφές ; *R.* кофе, koffé ; *Turk.* chaube ; *Arab.* bun ; *Pers.* kawa ; *Hind.*, *Guz.* kawa, coffee ; *Tam.* capie-cottay ; *Cing.* copi-cotta ; *Mal.* kawa.

COLOCYNTH.—*Fr.* coloquinte ; *It.*, *Sp.* coloquíntida ; *P.* coloquintos ; *G.* Koloquinte ; *Du.* bitter-appelen ; *Da.*, *Sw.* coloqvint ; *Turk.* dahak ; *Arab.*, *Pers.* Hun-zil ; *Hind.*, *Guz.* Indrain ; *Sans.* indravaruni, vishala ; *Beng.* makhal ; *Tam.* peycoomutikai ; *Cing.* titta commodoo.

COLOMBO-ROOT, or CALUMBO-ROOT.—*Fr.* racine de Columbo ; *It.* radice di Columbo ; *P.* raiz de Columba ; *G.* Kolumba-wurzel ; *Du.* Kolumbo-wortel ; *Da.* Columba-röd ; *Sw.* Kolumba-rot ; *Hind.*, *Guz.* Kalamb-ka-jur ; *Tam.* Columboo vayr ; *Cing.* Kalamboo-khoo.

CONEY, or RABBIT (*Lat.* cuniculus).—*Fr.* lapin ; *It.* coniglio ; *Sp.* conejo ; *P.* coelho ; *G.* Kaninchen ; *Du.* konijn ; *Da.* kanin ; *Sw.* kanin ; *Gr.* κουνάδιον, κουνέλιον ; *R.* кролик, królik.

COPAL.—*F.*, *Sp.*, *P.* copal ; *G.* Kopal ; *Du.* kopal ; *Da.* ; copal ; *Sw.* kopal ; *R.* копалъ, kopáll ; *Hind.*, *Guz.* chundroos.

COPPER (*Lat.* cuprum, *i.e.*, κύπριος χαλκός, Cyprian brass, *Pliny*).—*F.* cuivre ; *It.* rame ; *Sp.* cobre ; *P.* cobre ; *G.* Kupfer ; *Du.* koper ; *Da.* kobber ; *Sw.* koppar ; *Gr.* χαλκός ; *R.* (красная) мѣдь, (krasnaya) myêd' ; *Arab.* nehass ; *Pers.* miss ; *Sans.* tamra, tamraka ; *Hind.* thamba ; *Tam.* shemboo ; *Mal.* tambaga ; *Chin.* tung.

Hosted by Google

COPPERAS (Green vitriol, sulphate of iron).—*F.* couperose, sulfate de fer; *It.* vitriolo verde, solfato di ferro; *Sp.* caparrosa, vitriolo verde; *P.* caparrosa; *G.* grüner Vitriol; *Du.* koperrood; *Da.*, *Sw.* vitriol; *Gr.* βιτριόλιον πράσινον; *R.* **купоросъ**, kuporóss; *Hind.* heracussie, heratootia; *Pers.* zunkur madeenee, tootiya subz; *Tam.* annabugdie; *Mal.* taroosee

CORAL (*Gr. through Lat.*).—*F.* corail; *It.* corallo; *Sp.*, *P.* coral; *G.* Koralle; *Du.* koraal; *Da.* koral; *Sw.* korall; *Gr.* κοράλλιον; *R.* **кораллъ**, koráll; *Arab.* besed; *Pers.* murjan; *Sans.* vidruma, prabala; *Hind.* murjan, munga; *Tam.* pavalum; *Cing.* bubulo; *Mal.* poalum.

CORIANDER-SEED (*Lat.* coriandrum).—*F.* coriandre; *It.*, *Sp.* coriandro; *P.* coentro; *G.* Koriander (saamen); *Du.*, *Da.* coriander; *Sw.* koriander; *Arab.* kezeerah; *Per.* kushnîz; *Hind.* dhunnia; *Sans.* dhanyaka; *Tam.* cottamillie; *Cing.* cotum-barroo; *Mal.* mety.

CORK (*Lat. cortex*, bark; *Suber*, the cork-tree.)—*F.* liége; *It.* sughero; *Sp.* corcho; *P.* sobreiro de cortica; *G.* Kork; *Du.* kurk; *Da.* kork; *Sw.* kork; *Gr.* φελλός; *R.* **корка**, **пробка**, korka, probka; *Hind.*, *Guz.* bhooj.

CORN (*Ags.* corn, *kindred with Lat.* granum).—*F.* blé, froment; *It.* grano, frumento; *Sp.* grano; *P.* grão; *G.* Korn; *Du.* koren; *Da.*, *Sw.* korn; *Gr.* σῖτος; *R.* **верно**, **жито**, zerno, zhīto; *Hind.*, *Guz.* dhan.

COTTON (*Arabic*).—*F.* coton; *It.* cotone, bambagia; *Sp.* algodon; *P.* algodão; *G.* Baumwolle (tree-wool); *Du.* katoen, boomwol; *Da.* bomuld; *Sw.* bomull, kattun; *Gr.* βαμβάκιον; *R.* **хлопчатая бумага**, khloptsháta bumága; *Arab.* kutun; *Pers.* pumba; *Sans.* kapasa; *Hind.* ruhie; *Guz.* ruhie, kapoos; *Mal.* kapas.

COWRIES (*Hind.*).—*F.* coris, cauris, bouges; *It.* cori, porcellane; *Sp.* bucios, zimbos; *P.* buzios, zimbos, cauris; *G.*, *Du.* Kauris; *Hind.*, *Guz.* cowrie.

CRAB (*Ags.* crabba).—*Lat.* cancer; *F.* cancer; *It.* granchio; *Sp.* cangrejo; *P.* caranguejo; *G.* Krebs; *Du.* krab; *Da.* krabbe; *Sw.* krabba; *Gr.* καραβίδα; *R.* **морской паукъ**, morskóĭ páük.

CRAW-FISH (Cray-fish, *corrup. of Fr.*).—*F.* écrevisse; *It.* gambero; *Sp.* cangrejo de agua dulce; *P.* caranguejo dos rios; *G.* Bachkrebs; *Du.* rivierkreeft; *Da.* krebs; *Sw.* kräfta; *R.* **ракъ**, rakk.

CUCUMBER (*Ags.* cucumer, *from Lat.* cucumis-eris).—*F.* concombre; *It.* cetriuolo; *Sp.* cohombro; *P.* pepino; *G.* Gurke; *Du.* komkommer; *Da.* agurk; *Sw.* gurka; *Gr.* αγγούριον; *R.* **огурецъ**, oghuréts.

Hosted by Google

CURRANT (Garden).—*F.* groseille à grappes ; *It.* ribes ; *Sp.* grosella ; *G.* Johannisbeere ; *Du.* aalbes ; *Da.* ribs ; *Sw.* vinbär ; *Gr.* φραγκοστάφυλον ; *R.* **смородина,** smoródina.

CURRANT (*from Corinth*).—*F.* raisin de Corinthe ; *It.* uvepasse di Corinto ; *Sp.* pasas de corinto ; *P.* uvas de Corintho ; *G.* Korinthen ; *Du.* krent ; *Da.* korender ; *Sw.* korinter ; *Gr.* κοραντία, κουραντία ; *R.* **коринка,** korinka.

CUTTLE-FISH (*Ags.* cudele ; *Lat.* sepia ; *from Gr.*).—*F.* sèche ; *It.* seppia ; *Sp.* xibia, jibia ; *P.* siba ; *G.* Blackfisch, Tintenfisch ; *Du.* inktvisch ; *Da.* blæksprutte ; *Sw.* bläckfisk ; *Gr.* σηπιά, καλαμάριον ; *R.* **каракатица,** karakátitsa.

DATE (*Gr.* δάκτυλος, *through Lat.*).—*F.* datte ; *It.* dáttero ; *Sp.* dátil ; *P.* támara ; *G.* Dattel ; *Du.* dadel ; *Da.* daddel ; *Sw.* dadel ; *Gr.* φοινίκιον ; *R.* **финикъ,** phīnīk ; *Pers.* khurma ; *Hind.* kajoor (*dried do.* kharack).

DIAMOND (*corruption of* adamant, *Gr.*).—*F.* diamant ; *It.*, *Sp.*, *P.* diamante ; *G.*, *Du.* Diamant ; *Da.* diamant ; *Sw.* demant ; *Gr.* διαμάντιον ; *R.* **алмазъ,** almázz ; *Arab.*, *Pers.* almas ; *Hind.* heera.

DOG (*Fr.* dogue ; *Ger.* dogge).—*Lat.* canis ; *F.* chien ; *It.* cane ; *Sp.* perro ; *P.* cão ; *G.* Hund ; *Du.* hond ; *Da.*, *Sw.* hund ; *Gr.* σκύλος, κύων ; *R.* **собака,** sobáka.

DOWN (*Da.*).—*F.* duvet ; *It.* piuma ; *Sp.* plumon, plumazo ; *P.* pennuyem ; *G.* Flaumfeder, Daune ; *Du.* dons ; *Da.* duun ; *Sw.* dun ; *Gr.* χνούδιον ; *R.* **пухъ,** pukh.

DRAGON'S-BLOOD.—*F.* sang-dragon ; *It.* dragante ; *Sp.* sangre de dragon ; *P.* sangue de dragão ; *G.* Drachenblut ; *Du.* drakenbloed ; *Da.* drageblod ; *Sw.* drakeblod ; *R.* **драконова кровь,** drakónova-krov' ; *Arab.* damulakhwain ; *Pers.* khuni-shavan ; *Sans.* catukamrigarakta ; *Hind.* heeraduckkun ; *Tam.* kandamoorgarittum.

DUCK (*fr. verb* to duck ; *Lat.* anas).—*F.* canard ; *It.* anitra ; *Sp.* anade ; *P.* adem ; *G.* Ente ; *Du.* eend ; *Da.* and ; *Sw.* and, anka ; *Gr.* πάπια, νήσσα ; *R.* **утка,** utka.

EARTH (*Ags.* eorthe ; *Lat.* terra).—*F.* terre ; *It.* terra ; *Sp.* tierra ; *P.* terra ; *G.* Erde ; *Du.* aarde ; *Da.*, *Sw.* jord ; *Gr.* χῶμα ; *R.* **земля,** zemlyá.

EBONY (*Gr.*, *Lat.*, *from Heb.*).—*F.* ébène ; *It.*, *Sp.*, *P.* ebano ; *G.* Ebenholz ; *Du.* ebbenhout ; *Da.* ibenholt ; *Sw.* ebenholts ; *Gr.* ἔβενος ; *R.* **эбенъ,** ebben ; *Hind.* abnoos ; *Beng.* kendoo.

EEL (*Ags.* æl ; *Lat.* anguilla).—*F.* anguille ; *It.* anguilla ; *Sp.* anguila ; *P.* anguia ; *G.*, *Du.*, *Da.* Aal ; *Sw.* ål ; *Gr.* ἐγχέλιον ; *R.* **угорь,** ughór'.

EGG (*Ags.* æg ; *Lat.* ovum).—*F.* œuf ; *It.* uovo ; *Sp.* huevo ; *P.* ovo ; *G.*, *Du.* Ei ; *Da.* æg ; *Sw.* ägg ; *Gr.* ἀυγόν ; *R.* **яйцо,** yaïtsó.

Hosted by Google

ELDER (*Ags.* ellen ; *Lat.* sambucus).—*F.* sureau ; *It.* sambuco ; *Sp.* sauco ; *P.* sabugueiro ; *G.* Holunder ; *Du.* vlierboom ; *Da.* hyldetræ ; *Sw.* fläder (buske) ; *Gr.* κουφόξυλον.

ELEPHANT (*Gr. through Lat.*)—*F.* éléphant ; *It.*, *Sp.* elefante ; *P.* elephante ; *G.* Elephant ; *Du.* olifant ; *Da.* elephant ; *Sw.* elefant ; *Gr.* ἐλέφαντας ; *R.* **слонъ**, slonn.

ELM (*Ags.* ellm ; *Lat.* ulmus).—*F.* orme ; *It.*, *Sp.*, *P.* olmo ; *G.* Ulme ; *Du.* olm ; *Da.* almtræ ; *Sw.* almträd ; *Gr.* πτελέια ; *R.* **вязъ. илемъ**, vyaz, īlem.

EMERALD (*Gr., through Lat. and Norman French*).—*F.* émeraude ; *It.* smeraldo ; *Sp.*, *P.* esmeralda ; *G.*, *Du.*, *Da.*, *Sw.* Smaragd ; *Gr.* σμάραγδος ; *R.* **изумрудъ, смарагдъ**, izumrúd, smaráght.

EMERY (*Lat.* smiris).—*F.* émeri ; *It.* smeriglio ; *Sp.*, *P.* esmeril ; *G.* Schmergel ; *Du.* amaril ; *Da.*, *Sw.* smergel ; *R.* **наждакъ**, nazhdák.

ERMINE.—*F.* hermine ; *It.* ermellino ; *Sp.* armiño ; *P.* arminho ; *G.* Hermelin ; *Du.* hermelijn ; *Da.*, *Sw.* hermelin ; *Gr.* κακούμιον ; *R.* **горностай**, ghornostaï.

FEATHERS (*Ags.* feder ; *Lat.* penna, pluma).—*F.* plume ; *It.* piume ; *Sp.*, *P.* plumas ; *G.* Federn ; *Du.*, vederen ; *Da.* fjæder ; *Sw.* fjäder ; *Gr.* πτερά ; *R.* **перя**, perya ; *Hind.* pur.

FENNEL (*Lat.* fœniculum).—*F.* fenouil ; *It.* finocchio ; *Sp.* hinojo ; *P.* funcho ; *G.* Fenchel ; *Sw.* fenkål ; *R.* **воложенкій укропъ**, volozhskii ukrop ; *Arab.* razeeanuj ; *Pers.* badeeyan ; *Sans.* madhurika ; *Hind.* mayuri, wurrialee ; *Tam.* perun-siragum ; *Cing.* dewadooroo.

FIG,-S (*Lat.* ficus).—*F.* figue,-s ; *It.* fico, fichi ; *Sp.* higo,-s ; *P.* figo,-s ; *G.* Feige,-n ; *Du.* vijg,-en ; *Da.* figen ; *Sw.* fikon ; *Gr.* σῦκον,-α ; *R.* **смоква-ы**, smókva,-y ; *Arab.* teen ; *Pers.*, *Hind.* anjeer ; *Sans.* udumvara ; *Tam.* simie attie pullum ; *Cing.* rata attika.

FISH (*Ags.* fisc ; *Lat.* piscis).—*F.* poisson ; *It.* pesce ; *Sp.* pez ; *P.* peixe ; *G.* Fisch ; *Du.* visch ; *Da.*, *Sw.* fisk ; *Gr.* ὀψάριον ; *R.* **рыба**, rýba.

FLAX (*Ags.* flæcs ; *Lat.* linum).—*F.*, lin ; *It.*, *Sp.* lino ; *P.* linho ; *G.* Flachs ; *Du.* vlas ; *Da.* hör ; *Sw.* lin ; *Gr.* λινάριον ; *R.* **ленъ**, leönn.

FLESH (*Ags.* flæsc ; *Lat.* caro).—*F.* chair ; *It.*, *Sp.*, *P.* carne ; *G.* Fleisch ; *Du.* vleesch ; *Da.* kjöd ; *Sw.* kött ; *Gr.* κρέας ; *R.* **мясо**, myasso.

FLINT (*Ags.* flint ; *Lat.* silex).—*F.* caillou, pierre-à-feu ; *It.* selce ; *Sp.* pedernal ; *P.* pederneira ; *G.* Feuerstein ; *Du.* vuursteen, keisteen ; *Da.* flintesteen ; *Sw.* flintasten ; *Gr.* τζακουμακόπετρα ; *R.* **кремень**, kremen' ; *Hind.* chachmak.

FLOUR (*Lat. flos ;* flour, *Lat.* farina).—*F.* farine ; *It.* farina ; *Sp.* flor de harina : *P.* farinha ; *G.* Mehl ; *Du.*, *Da.* meel ; *Sw.* mjöl ;

Hosted by Google

Gr. ἀλεύριον; *R.* **мука,** muká; *Hind.* atta; *Tam.* godum-bay-mao; *Cing.* tringoo-pittay.

FLOWERS (*Lat.* flores; *Ags.* blostman).—*F.* fleurs; *It.* fiori; *Sp.*, *P.* flores; *G.* Blumen; *Du.* bloemen; *Da.* blomster; *Sw.* blommar; *Gr.* ἄνθοι, λουλούδια; *R.* **цвѣтки,** tsvyetky.

FURS.—*F.* fourrure; *It.* pelle, pelliccia; *Sp.* piel; *P.* pelle; *G.* Pelz, Rauchwaaren; *Du.* bont; *Da.* peltsværk; *Sw.* pelsverk; *Gr.* γοῦνα; *R.* **мѣхъ,** myêkh.

FUSTIC (*from Lat.* fustis).—*F.* fustet; *It.* legno giallo di Brasilio; *Sp.* fustoc, fustete; *P.* jataiba; *G.* Gelbholz, Brasilienholz; *Du.* geelhout; *Da.* brasilietræ; *Sw.* gul bresilja.

GALANGAL.—*F.*, *It.*, *Sp.* galanga; *P.* galangal; *G.* Galgant; *Du.* galgel; *Da.* galange; *Sw.* galgant; *Hind.* colenjun.

GALBANUM (*Heb.*, *Arab.*, *Gr.*, *and Lat.*).—*F.* galbanum; *It.*, *Sp.*, *P.* galbano; *G.* Mutterharz; *Du.*, *Da.*, *Sw.* galbanum; *Gr.* γάλβανον; *R.* **галбанъ,** ghálban; *Arab.* barzud; *Pers.* beerzud; *Hind.* bireeja.

GALENA (*Gr.*).—*F.* plomb sulfuré, galène; *It.* galena; *Sp.*, *P.* galena, sulfureto di plomo; *G.* Bleiglanz; *Du.* loodzwavel; *Da.* blyglands; *Sw.* blyglans; *Gr.* μολυβόχωμα; *R.* **свинцовая руда,** svinzóvaya rúda.

GALLS (*Lat.* galla).—*F.* noix de galles; *It.* galle; *Sp.* agallas; *P.* galhas; *G.* Gallapfel; *Du.* galappel; *Da.* galæble; *Sw.* galläple; *Gr.* κηκιδια; *R.* **чернильный орѣхи,** cherníl'nyĭ, orêkhi; *Arab.* afis; *Pers.* mazu; *Sans.* mayuphal; *Hind.* maya, majowphul; *Tam.* machakai; *Cing.* masaka.

GAMBOGE (*from* Cambodja).—*F.* gomme gutte; *Sp.* gutagamba; *F.* gutta gamba; *G.* Gummigutt, Gummi Camboja; *Du.* guttegom; *Da.* gummigut; *Sw.* gummigutta; *Gr.* κομμίδιον; *R.* **гуммигутъ,** gummigút; *Arab.* ossara rewund; *Hind.* ravunchenee-seerah; *Tam.* mukki; *Cing.* yokkatoo; *Siamese*, rong.

GARLIC (*Ags.* garleac, *i.e.*, spear-leek; *Lat.* allium).—*F.* ail; *It.* aglio; *Sp.* ajo; *P.* alho; *G.* Knoblauch; *Du.* knoflook; *Da.* hvidlög; *Sw.* lök; *Gr.* σκόρδον; *R.* **чеснокъ,** tshesnók; *Arab.* soom; *Pers.* seer; *Sans.* lasuna; *Hind.* lussun; *Tam.* vullay pundoo; *Cing.* soodooloonoo; *Mal.* bavung-pootie.

GARNET.—*F.* grenat; *It.* granato; *Sp.* granate; *P.* granada; *G.* Granat; *Du.* granaat; *Da.*, *Sw.* granat; *R.* **гранатъ,** ghranát.

GAS (*Ags.* gast, breath?)—*F.* gaz; *Sp.* gas; *P.* gaz; *G.*, *Du.*, *Da.*, *Sw.* gas; *R.* **газъ,** gass.

GENTIAN (*Lat.* gentiana).—*F.* gentiane; *It.* genziana; *Sp.*, *P.* genciana; *G.* Enzian; *Du.* gentiaan; *Da.* enzian; *Sw.* gentian; *Gr.* γεντιανή; *R.* **горчанка,** ghortshánka.

Hosted by Google

GINGER (*Arabic, through Gr. and Lat.* zingiber).—*F.* gingembre; *It.* zenzevero; *Sp.* gengibre; *P.* gingivre; *G.* Ingwer; *Du.* gember; *Da.* ingefær; *Sw.* ingefära; *Gr.* ζιγγίβερις; *R.* **инбирь**, ínbir'; *Arab.* zingebel; *Pers.* zunjebeel; *Sans.* sunthi; *Hind.* adruck, soont; *Tam.* sukka; *Cing.* inghuru; *Mal.* alia; *Jav.* jaiaking.

GLASS (*Ags.* glæs; *Lat.* vitrum).—*F.* verre; *It.* vetro; *Sp.* vidrio; *P.* vidro; *G.*, *Du.*, *Da.*, *Sw.* Glas; *Gr.* γυαλίον; *R.* **стекло**, stekló; *Hind.*, *Guz.* kach.

GLUE (*Lat.* gluten).—*F.* colle forte; *It.* colla; *Sp.*, *P.* cola; *G.* Leim; *Du.* lijm; *Da.* liim; *Sw.* lim; *Gr.* κόλλα; *R.* **клеи**, kléï; *Hind.*, *Guz.* sirrus.

GOAT (*Ags.* gát; *Lat.* capra).—*F.* chèvre; *It.* capra; *Sp.*, *P.* cabra; *G.* Ziege; *Du.* geit; *Da.* ged; *Sw.* get; *Gr.* γίδα; *R.* **козелъ**, kozýoll.

GOLD (*Ags. M.-Goth*, gold; *Lat.* aurum).—*F.* or; *It.* auro; *Sp.* oro; *P.* ouro; *G.* Gold; *Du.* goud; *Da.*, *Sw.* guld; *Gr.* χρυσός; *R.* **золото**, zóloto; *Arab.* zeheb; *Pers.* thil; *Sans.* swarna; *Hind.* suna; *Mal.* mas.

GOOSE (*Ags.* gós; *Lat.* [g]anser).—*F.* oie; *It.* oca; *Sp.* ansar; *P.* gansi, pato; *G.*, *Du.* Gans; *Da.* gaas; *Sw.* gås; *Gr.* χῆνα; *R.* **гусь**, ghus'.

GOOSEBERRY (*i.e.*, gorse, *or* prickle-berries).—*F.* groseilles; *It.* uva spina; *Sp.* grosella, espina crespa; *P.* uva espim; *G.* Stachelbeere; *Du.* kruisbes; *Da.* Stikkelsbær; *Sw.* stickelbär, krusbär; *Gr.* αγριοστάφυλον; *R.* **крыжовникъ**, kryzhóvnik.

GRANITE (*Lat.* granum, *grain*).—*F.* granit; *It.*, *Sp.*, *P.* granito; *G.* Granit; *Du.* graniet; *Da.*, *Sw.* granit; *R.* **гранитъ**, ghranítt.

GRAPES (*Fr.* grappes de raisin; *Lat.* uva-æ).—*F.* raisins; *It.* uve, grappoli; *Sp.* uvas; *P.* uvas; *G.* Trauben; *Du.* druiven; *Da.* druer, viindruer; *Sw.* drufva, vindrufva; *Gr.* βότρυς; *R.* **винограды**, vinoghrády; *Arab.* junb; *Pers.*, *Hind.* ungoor; *Guz.* darakh; *Mal.* booangoor.

GRASS (*Ags.* gœrs; *Lat.* herba).—*F.* herbe; *It.* erba; *Sp.* yerba; *P.* herva; *G.*, *Du.* Gras; *Da.* græs; *Sw.* gräs; *Gr.* χόρτα; *R.* **трава**, travá.

GUM (*Gr.* κόμμι; *Lat.* gummi; *Ags.* goma).—*F.* gomme; *It.* gomma; *Sp.* goma; *P.* gomma; *G.* Gummi; *Du.* gom; *Da.* gummi; *Sw.* gummi; *Gr.* κόμμιον; *R.* **смола**, **гумми**, smolá, ghummi; *Hind.*, *Guz.* goondur.

GUM ARABIC.—*Fr.* gomme arabique; *It.*, *P.* gomma arabica; *G.* Arabische Gummi; *Du.* arabische gom; *Arab.* samagh Arabee; *Sans.* kapitha; *Hind.*, *Guz.* Arabee goondur.

GYPSUM (*Gr. through Lat.*).—*Fr.* gypse; *It.* gesso; *Sp.* yeso; *P.*

Hosted by Google

gesso ; *G.* Gips ; *Du.* gips ; *Da.* gibs ; *Sw.* gips ; *Gr.* γύψον ; *R.* **гипсъ**, ghips.

HADDOCK (*Lat.* merula, *a whiting*).—*F.* merluche ; *It.* merluzzo ; *Sp.* merluza ; *P.* pescadinha, *G.* Kabeljau, Schellfisch ; *Du.* schelvisch ; *Da.* kuller ; *Sw.* kolja ; *R.* **вахня**, vákhnya.

HAIR (*Ags.* hær ; *Lat.* capillus).—*F.* cheveu ; *It.* capello ; *Sp.* cabello, pelo ; *P.* cabello ; *G.*, *Du.*, *Da.* Haar ; *Sw.* hår ; *Gr.* τρίχα ; *R.* **волосъ**, vóloss ; *Hind.*, *Guz.* ball.

HAY (*Ags.* heg) ; *Lat.* fœnum.—*F.* foin ; *It.* fieno ; *Sp.* heno ; *P.* feno ; *G.* Heu ; *Du.* hooi ; *Da.* hö ; *Sw.* hö ; *Gr.* σανόν ; *R.* **сѣно**, syêno ; *Hind.*, *Guz.* ghans.

HAZEL NUTS (*Ags.* hasel ; *Lat.* avellana).—*F.* noisettes, avelines ; *It.* nocciuole, aveline ; *Sp.* avellanas ; *P.* avellãas ; *G.* Haselnusse ; *Du.* hazelnooten ; *Da.* hasselnöd ; *Sw.* hasselnöt ; *Gr.* λεπτοκάρυον ; *R.* **орѣли**, orêkhi ; *Pers.*, *Hind.* fendook ; *Beng.* bindik.

HELLEBORE (*Gr. through Lat.*).—*Fr.* hellébore ; *It.* elleboro ; *Sp.* eleboro ; *P.* helleboro ; *G.* Nieswurz ; *Du.* nieskruid ; *Da.* nyseurt ; *Sw.* nys-gräs ; *Gr.* ἑλλέβορος, σκάρφη ; *R.* **вшивый порошокъ**, vshívyĭ poroshók ; *Arab.* kherbek, karbek-es-wad ; *Pers.* kherbek seeah ; *Hind.* cudoo, kali kootkie ; *Sans.* katurohina ; *Tam.* kodagaroganie ; *Cing.* calurana.

HEMP (*Ags.* hænep ; *Lat.* cannab-is).—*F.* chanvre ; *It.* canape ; *Sp.* cáñamo ; *P.* cánamo ; *G.* Hanf ; *Du.* hennep ; *Da.* hamp ; *Sw.* hampa ; *Gr.* κανάβιον ; *R.* **конопель**, konópel' ; *Arab.* kinnub ; *Hind.* sunn.

HERRING-S (*Ags.* hæringc, *the fish that came in a* heer, *or* host ; *comp.* viking *from* vik).—*F.* hareng-s ; *It.* aringha-e ; *Sp.*, *P.* arenque-s ; *G.* Häring-e ; *Du.* haring-en ; *Da.* sild ; *Sw.* sill ; *Gr.* ἀρελγγα ; *R.* **сельди**, **селедки**, sel'dĭ, selyódkĭ.

HIDE (*Ags.* hyde ; *Lat.* pellis).—*F.* peau ; *It.* pelle, cuojo ; *Sp.* piel, cuero ; *P.* pelle, coiros ; *G.* Haut, Fell ; *Du.* huid, huiden ; *Da.* hud ; *Sw.* hud ; *Gr.* δέρματα ; *R.* **шкуры**, shkury ; *Hind.* chumra ; *Guz.* chamroo.

HOG, or SWINE (*Welsh*, hwch ; *Ags.* swín ; *Lat.* porcus).—*F.* pourceau ; *It.* porco ; *Sp.* puerco ; *P.* porco ; *G.* Schwein ; *Du.* varken, zwijn ; *Da.* sviin ; *Sw.* svin ; *Gr.* γουρούνιον, χοῖρος ; *R.* **свинья**, svinyá.

HONEY (*Ags.* hunig ; *Lat.* mel).—*F.* miel ; *It.* miele ; *Sp.* miel ; *P.* mel ; *G.* Honig ; *Du.* honig ; *Da.* honning ; *Sw.* håning ; *Gr.* μέλι ; *R.* **медъ**, meöd (compare *mead*) ; *Arab.* ussul-al-neh, injubeen ; *Pers.* shahud ; *Sans.* madhu ; *Hind.* madh, shahud ; *Guz.* mudh ; *Tam.* tayn ; *Cing.* meepanny ; *Mal.* ayermadoo.

HOPS (*Du.*, *unknown to Anglo-Saxons ; introduced from Flanders*,

Hosted by Google

1524; *Lat.* lupulus, humulus).—*F.* houblon; *It.* lupolo; *Sp.*, *P.* lupulo; *G.* Hopfen; *Du.* hoppen; *Da.*, *Sw.* humle; *Gr.* χούμελη; *R.* **хмѣль**, khmyêl'.

HORN (*Ags.* horn; *Lat.* cornu).—*F.* corne; *It.* corno; *Sp.* cuerno; *P.* corno; *G.* Horn; *Du.* hoorn; *Da.*, *Sw.* horn; *Gr.* κέρας κέρατον; *R.* **рогъ**, rogg; *Hind.*, *Guz.* sing.

HORSE (*Ags.* hors; *Lat.* equus, caballus).—*F.* cheval; *It.* cavallo; *Sp.* caballo; *P.* cavallo; *G.* Pferd, Ross; *Du.* paard; *Da.* hest; *Sw.* häst; *Gr.* 'άλογον, 'ίππος; *R.* **лошадь**, loshad'.

HORSE-RADISH.—*F.* rave, raifort; *It.* rafano; *Sp.* rábano picante; *P.* rabão de cavallo; *G.* Meer-rettig; *Du.* rammenas; *Da.* peberrod; *Sw.* pepparrot; *Gr.* χρένον; *R.* **хрѣнъ**, khrên.

ICE (*Ags.* ís; *Lat.* glacies).—*F.* glace; *It.* ghiaccio; *Sp.* hielo; *P.* gelo, caramelo; *G.* Eis; *Du.* ijs; *Da.* iis; *Sw.* is; *Gr.* πάγος; *R.* **ледъ**, leódt; *Pers.*, *Hind.* yach.

INDIA-RUBBER, or CAOUTCHOUC (*Popayan*).—*F.* gomme élastique; *It.* gomma elastica; *Sp.* goma elástica; *P.* borracha, gomma elastica; *G.* Feder-harz, Kautschuk; *Du.* verderhars, gomelastiek; *Da.*, *Sw.* gummi; *R.* **резина**, rezīna.

INDIGO (*Lat.* indicum, *Indian*).—*F.* indigo; *It.* indaco; *Sp.* añil; *P.* anil (*from Arab.* an-nîl); *G.*, *Du.*, *Da.*, *Sw.* Indigo; *Gr.* ἰνδικον; *R.* **кубовая краска**, kubováya kraska; *Arab.*, *Pers.* neel; *Hind.*, *Guz.* neel, goolee; *Sans.* nili; *Tam.* neelum; *Cing.* nil; *Mal.* taroom.

INK (*Du.*).—*F.* encre; *It.* inchiostro; *Sp.*, *P.* tinta; *G.* Tinte; *Du.* inkt; *Da.* blæk; *Sw.* skrifbläck; *Gr.* μελάνη; *R.* **чернило**, tshernīlo; *Pers.*, *Hind.*, *Guz.* shai.

IRON (*Ags.* íren; *Lat.* ferrum).—*F.* fer; *It.* ferro; *Sp.* hierro; *P.* ferro; *G.* Eisen; *Du.* ijzer; *Da.* Jern; *Sw.* jern; *Gr.* σίδηρος; *R.* **желѣзо**, zhelêzo; *Arab.* hedeed; *Pers.* ahan; *Sans.* loha; *Hind.*, *Guz.* looah; *Tam.* eerumboo; *Cing.* yakada; *Mal.* bessee; *Chin.* tee.

IRONWOOD (*Botan.* Sideroxylon).—*F.* bois de fer; *It.* legno di ferro; *Sp.* palo hierro; *P.* pao de ferro; *G.* Eisenholz; *Du.* Ijzerhout; *Da.* jerntræ; *Sw.* jernträ; *Gr.* σιδηρόξυλον; *R.* **твердодревникъ**, tverdodrévnik.

ISINGLASS.—*F.* colle de poisson; *It.* cola di pesce; *Sp.* colapez; *P.* colla de peixe; *G.* Fischleim, Hausenblase; *Du.* huisblad, vischlijm; *Da.* huusblas; *Sw.* husblås; *Gr.* ψαρόκολλα; *R.* **рыбій клей**, rýbiĭ kleĭ.

IVORY (*Lat.* ebur).—*F.* ivoire; *It.* ebure; *Sp.* martil; *P.* marfim; *G.* Elfenbein; *Du.* elpenbeen, ivoor; *Da.* elfenbeen; *Sw.* elfenben; *Gr.* ελεφάντινον; *R.* **слоновая кость**, slónovaya kost' = elfen-

Hosted by Google

bein ; *Pers.* dundhan-i-feil ; *Hind.*, *Guz.* huthee **danth** (from elephant) ; moye-danth (from walrus).

JALAP (*Sp.*).—*F.* jalap ; *It.* scialappa ; *Sp.* jalapa ; *P.* jalapa ; *G.* Jalapp ; *Du.*, *Da.* jalap ; *Sw.* jalappa ; *R.* **ялапа,** yalappa.

JASPER (*Gr.* ἰάσπις ; *Lat.* iaspis, *from Heb.* yaspah).—*F.* jaspe ; *It.* disapro ; *Sp.* jáspe ; *P.* jaspe ; *G.* Jaspiss ; *Du.*, *Da.*, *Sw.* jaspis ; *Gr.* ἰάστιδα ; *R.* **яшма,** yashmá, **ясписъ,** yaspīs'.

JET (*Gr.* γαγάτης, *from* Gage, *a river of ancient Lycia*).—*F.* jais ; *It.* gagata, lustrino, pietra nera ; *Sp.* azabache ; *P.* azeviche ; *G.* Gagat, Schwarzer Bernstein ; *Du.* git ; *Da.* sort agat ; *Sw.* gagat ; *Gr.* γαγάτης ; *R.* **гагатъ,** gagátt.

JUNIPER (*Lat.* juniperus).—*F.* genièvre ; *It.* ginepro ; *Sp.* enebro ; *P.* zimbro ; *G.* Wachholder ; *Du.* Genever ; *Da.* enebær ; *Sw.* enbuske ; *Gr.* ἀρκευθος ; *R.* **можжевельникъ,** mozh-zhevél'nīk ; *Arab.* hoober.

KELP.—*F.* soude ; *It.* soda ; *Sp.* sosa ; *P.* sal de soda ; *G.* Aschensalz ; *Du.* weedasch, Kelp ; *Sw.* Skottländsk soda ; *Gr.* στακτόνερον.

KERMES (*Arab.* quirmiz, *scarlet*, through *Span.*).—*F.* kermès ; *It.* chermes ; *Sp.* quérmes ; *P.* kermes ; *Ger.* Kermes, Scharlachbeere ; *Du.* scharlakenbezie ; *Da.* skarlagens bær ; *Sw.* kermesbär ; *Gr.* κρεμέζιον, πρινοκόκκιον ; *R.* **червецъ,** tchervéts, **листососъ,** līstosóss ; *Hind.*, *Guz.* kirmiz, kermes.

KINO.—*F.* gomme de kino ; *It.* chino ; *Sp.* quino ; *G.* Kino-harz ; *Beng.* palass-goond.

LAC (*Sans.*, *Pers.*).—*F.* laque ; *It.* lacca ; *Sp.*, *P.* laca ; *G.* Lack ; *Da.* lak ; *Sw.* lack ; *Gr.* βερνίκιον ; *R.* **(гумми) лакъ,** (ghummi) láck ; *Arab.*, *Pers.* laak ; *Sans.* laksha ; *Hind.*, *Guz.* lakh ; *Tam.* komburruk ; *Cing.* lakada ; *Mal.* ambaloo ; *Jav.* balo.

LAVENDER (*Lat.* lavandula).—*F.* lavande ; *It.* spigo, lavendola ; *Sp.* espliego, lavandula ; *P.* alfazema ; *G.*, *Du.*, *Da.*, *Sw.* Lavendel ; *Gr.* νάρδος ; *R.* **увѣчная трава,** uvyêtshnaya travá.

LEAD (*Ags.* lead ; *Lat.* plumbum).—*F.* plomb ; *It.* piombo ; *Sp.* plomo ; *P.* chumbo ; *G.* Blei ; *Du.* lood ; *Da.* bly ; *Sw.* bly ; *Gr.* μολύβιον ; *R.* **свинецъ,** svinéts ; *Arab.* anuk ; *Pers.* surb ; *Sans.* sisaka ; *Hind.*, *Guz.* seesa ; *Tam.* eeum ; *Mal.* temaltam ; *Chin.* hih yen.

LEATHER (*Ags.* ledher ; *Lat.* corium).—*F.* cuir ; *It.* cuojo ; *Sp.* cuero ; *P.* coiro ; *G.*, *Du.* Leder ; *Da.* læder ; *Sw.* läder ; *Gr.* πετζίον ; *R.* **кожа,** kozha ; *Pers.* churm ; *Hind.* chumra ; *Guz.* chamroo.

LEECH (*Ags.* læce, *a physician, surgeon*).—*F.* sangsue ; *It.* sanguisuga ; *Sp.* sanguijuela ; *P.* sanguisuga ; *G.* Blutigel ; *Du.* bloedzuiger ; *Da.*, *Sw.* blodigel ; *Gr.* ἀβδέλλα ; *R.* **піявица,** piyávitsa ; *Arab.* aluk, kheeraheen ; *Pers.* zeloo ; *Sans.* jaluka ; *Hind.* jook ; *Tam.* attei ; *Cing.* koodalla ; *Mal.* patchet.

Hosted by Google

LEMON (*Gr. through Lat.*).—*F.* limon; *It.* limone; *Sp.* limon; *P.* limão; *G.* Limone; *Du.* limoen; *Da.*, lemon; *Sw.* limon; *Gr.* λειμόνιον; *R.* **лимонъ**, līmón; *Arab.* lemoon; *Pers.* leembo; *Hind.*, *Guz.* limboo, neemboo.

LETTUCE (*Lat.* lactuca, *from* lac, *milky juice*).—*F.* laitue; *It.* lattuga; *Sp.* lechuga; *P.* alface; *G.* Lattich; *Du.* latuw; *Da.* salat, laktuk; *Sw.* laktuk; *R.* **латукъ**, latúk; *Hind.*, *Guz.* kahoo.

LIME (*Ags.* lím, *glue, cement, mortar, whence limestone—the cementing stone; Lat.* calx).—*F.* chaux; *It.* calcina; *Sp.*, *P.* cal; *G.* Kalk, Leim; *Du.*, *Da.*, *Sw.* kalk; *Gr.* ἄσβεστος, κόλλα; *R.* **известь**, ízvest'; *Arab.* ahuk; *Pers.* nureh; *Sans.* churna; *Hind.* chuna; *Tam.* chunamboo; *Cing.* hunnoo; *Mal.* capoor.

LINDEN (*Ags.* linde; *Lat.* tilia).—*F.* tilleul; *It.* tiglio; *Sp.* tilo, teja; *P.* til, tilia; *G.* Linde; *Du.* linde-boom; *Da.* linde-træ; *Sw.* lind; *Gr.* φίλυρα; *R.* **липа**, lípa.

LINSEED.—*F.* graine de lin; *It.* semenza di lino; *Sp.* linaza; *P.* linhaça; *G.* Leinsamen; *Du.* lijnzaad; *Da.* hörfrö; *Sw.* linfrö; *Gr.* λιναρόσπορος; *R.* **льняное сѣмя**, l'nánoe syêma; *Arab.* buzruk; *Pers.* tukhem-i-kitan; *Sans.* uma, atisi; *Hind.* suf, tisi, ulsee; *Tam.* alleverei, sirru sannulverei; *Mal.* bidgierammee.

LIQUORICE (*corrupted from Gr.* glycyrhiza, *sweet-root*).—*F.* réglisse; *It.* regolizia, logorizia; *Sp.* regaliza; *P.* regoliz, alcaçuz; *G.* Süssholz, Lakritze; *Du.* zoethout; *Da.* lakris; *Sw.* lakrits; *Gr.* γλυκόῤῥιζα; *R.* **солодковый корень**, solodkovyĭ kóren'; *Arab.* uss-ul-soos; *Pers.* bikhmekeh; *Sans.* madhuka, yusti-madhuka; *Hind.*, *Guz.* jettimud; *Tam.* addimodrum; *Cing.* wellmie, olinde; *Mal.* urat-manis; *Jav.* oyotmanis.

LITHARGE (*Gr. through Lat.* Lithargyrium, *silver-stone*).—*F.* litharge; *It.* litargirio; *Sp.* almartaga; *G.* Glötte, Glätte; *Du.* gelit; *Da.* sölvskum, blyskum; *Sw.* glitt; *Gr.* λιθάργυρος; *R.* **глетъ**, glett; *Pers.* murdarsang; *Hind.* murdarsang, boodar; *Tam.* marudar-singhie.

LITMUS.—*F.* tournesol; *It.* tornasole; *Sp.* tornasól en pasta; *G.* Lackmuss; *Du.* lakmoes; *Da.* lakmus; *Sw.* lackmus.

LOBSTER (*Ags.* loppestre; *Lat.* gammarus, cammarus, astacus, locusta).—*F.* homard; *It.* gambero di mare; *Sp.* langosta; *P.* lagosta; *G.* Hummer; *Du.* zeekreeft; *Da.*, *Sw.* hummer; *Gr.* ἀστακός; *R.* **морской ракъ**, morskóy rakk.

LOGWOOD.—*F.* bois de Campêche; *It.* legno Campeggio; *Sp.* palo de Campéche; *P.* pão de Campeche; *G.* Campesche-holz, Blau-holz; *Du.* kampechehout; *Da.* Campechetræ; *Sw.* kampecheträd; *R.* **кампешское дерево**, kampésh-skoë dérevo.

MACE (*Gr.* μάκερ; *Lat.* macis).—*F.*, *It.*, *Sp.*, *P.* macis; *G.* Muskaten-

Hosted by Google

blüthe; *Du.* foelij; *Da.* muskatblomme; *Sw.* muskotblomma; *Gr.* μοσχοκάρυδον; *R.* **мушкатный цвѣтъ**, mushkatnyĭ tsvyêt; *Arab.* talzuffar; *Pers.* bez-baz; *Sans.* jatipatri; *Hind*, jaiputree, jaiwantry; *Tam.* jadiputrie; *Cing.* wassawassie; *Mal.* bunga-bua-pala; *Jav.* kambang-pala; *Bali*, bunga-pala.

MACKEREL (*Du.*).—*F.* maquereau; *It.* sgombro; *Sp.* escombro; *P.* cavalla; *G.* Makrele; *Du.* makreel; *Da.* makrel; *Sw.* makrill; *Gr.* σγόμβρος; *R.* **макрель**, makrél'.

MADDER (*Ags.* mæddere; *Lat.* rubia).—*F.* garance; *It.* robbia; *Sp.* rubia; *P.* ruiva; *G.* Krapp; *Du.* meekrap; *Da.* krap; *Sw.* krapp; *Gr.* ἐρυθρόδανον, ῥιζάριον; *R.* **марена, крапъ**, maryóna, krapp; *Arab.* fuh; *Pers.* ru-nas; *Sans.* manjishtha; *Hind.* munjeet; *Tam.* manjittie; *Cing.* well-mudutta.

MAGNESIA.—*F.* magnésie; *It.*, *Sp.*, *P.* magnesia; *G.* Magnesia, Bittererde; *Du.*, *Da.*, *Sw.* magnesia; *Sw.* talkjord.

MAGNET, or LOADSTONE (*Gr.* μάγνης, *from Magnesia in ancient Lydia; Lat.* magnes).—*F.* aimant; *It.* magnete, calamita; *Sp.* imán; *P.* iman; *G.* Magnet; *Du.* magneet, zeilsteen; *Da.*, *Sw.* magnet; *Gr.* μαγνήτης; *R.* **магнитъ**, magnít; *Pers.* ahan-subah; *Hind.*, *Guz.* chumuk puttur; *Tam.* kaundum.

MAHOGANY (*Carribbean*). — *F.* acajou; *It.* maogani; *Sp.* caóba, caobána; *P.* pão magno; *G.* Mahagony; *Du.* mahoniehout; *Da.* mahonitræ; *Sw.* mahogony; *R.* **красное дерево**, krasnoë dérevo.

MAIZE (*Gr.* μάζα, *through Lat.*).—*F.* maïs; *It.* saggina, grano Turco; *Sp.*, *P.* maiz; *G.* Mais, Türkischer Weizen; *Du.* Turksche tarwe; *Da.* mais, tyrkisk hvede; *Sw.* mais, Turkisk hvete; *Gr.* ἀραποσίτιον; *R.* **маисъ, кукуруза**, má-iss, kukurúza; *Hind.*, *Guz.* boota; *Beng.* mokka.

MALLOW (*Lat.* malva).—*F.* mauve; *It.*, *Sp.*, *P.* malva; *G.* Malve, Pappel; *Du.* maluwe; *Da.* katost; *Sw.* kattost; *Gr.* μολόχη; *R.* **просвирки**, prosvírkī.

MANGANESE (*Gr.* μαγγανέια, *sorcery, poisoning*). — *F.* manganèse; *It.*, *P.* manganese; *Sp.* manganesa; *G.* Braunstein, Mangan; *Du.* bruinsteen; *Da.* brunsteen; *Sw.* manganes, brunsten.

MANGO.—*F.* mangou; *It.*, *Sp.* mango; *P.* mangue; *G.* Mango; *Du.*, *Da.*, *Sw.* mango; *Hind.* amb; *Guz.* caree.

MAPLE (*Ags.* mapul; *Lat.* acer).—*F.* érable; *It.* acero; *Sp.* arce; *P.* bordo; *G.*, *Du.* Ahorn; *Da.* valbirk; *Sw.* lönn; *Gr.* σφένδαμνος; *R.* **кленъ**, klyón.

MARBLE (*Gr.* μαρμαίρω, to glitter, *hence Gr.* μάρμαρος; *Lat.* marmor, *the shining stone*).—*F.* marbre; *It.* marmo; *Sp.* mármol; *P.* marmore; *G.* Marmor; *Du.* marmer; *Da.*, *Sw.* marmor; *Gr.* μάρμαρον; *R.* **мраморъ**, mrámor; *Pers.*, *Hind.* murmur.

Hosted by Google

MARL (*name common to Welsh and Teutonic*).—*F.* marne ; *It.* terra grassa ; *Sp.*, *P.* marga ; *G.* Märgel ; *Du.*, *Da.*, *Sw.* mergel ; *R.* **мергель,** mergel', **рухлякъ,** rukhlyák.

MASTIC (*Gr. through Lat.*). *F.* mastic ; *It.* mastico, mastrice ; *Sp.* almaciga, almastiga ; *P.* mastique, almecega ; *G.* Mastix ; *Du.* mastic (gom) ; *Da.*, *Sw.* mastix ; *Gr.* μαστίχη ; *R.* **мастикъ,** mástik ; *Turk.* sakes ; *Arab.* arah, auluh Bagdadie ; *Pers.* kinneh ; *Hind.*, *Tam.* roomie, mustakie.

MEDLAR (*Ags.* mæd ; *Lat.* mespilum, *from Gr.* μέσπιλον).—*F.* nèfle ; *It.* nespola ; *Sp.* nispero ; *P.* nespera ; *G.*, *Du.*, *Da.*, *Sw.* Mispel ; *Gr.* μέσπιλον, νέσπουρον ; *R.* **кизиль,** kízīl'.

MERCURY (*Lat.* Mercurius).—*F.* mercure ; *It.* mercurio, argento vivo ; *Sp.*, *P.* mercurio ; *P.* azougue ; *G.* Quecksilber, Mercur ; *Du.* kwikzilver ; *Da.* qvægsölv ; *Sw.* qvicksilfwer ; *Gr.* ὑδράργυρος, διάργυρος ; *R.* **ртуть,** rtut' ; *Arab.* abuk, zibakh ; *Pers.* seemáb ; *Sans.* rasa, sutum, parada ; *Hind.* parah ; *Tam.* rasam ; *Mal.* rassa ; *Chin.* shwuy-yin.

MICA (*Lat.* mico, *to sparkle.*)—*F.*, *It.*, *Sp.*, *P.* mica ; *G.* Glimmererde ; *Du.* glimmer, mica ; *Da.*, *Sw.* glimmer.

MILK (*Ags.* meo-loc ; *Lat.* [g]lac ; *Gr.* ga-lak).—*F.* lait ; *It.* latte ; *Sp.* leche ; *P.* leite ; *G.* Milch ; *Du.*, *Da.* melk ; *Sw.* mjölk ; *Gr.* γάλα ; *R.* **молоко,** molokó ; *Arab.* laba ; *Pers.* sheer ; *Hind.* dood ; *Sans.* gokshira ; *Tam.* pashuin paal ; *Cing.* ellakerrie ; *Mal.* soosoo.

MILLET (*Lat.* milium).—*F.* mil ; *It.* miglio ; *Sp.* mijo ; *P.* milho miudo ; *G.* Hirse ; *Du.* gierst ; *Da.* hirse ; *Sw.* hirs ; *Gr.* κέγχριον ; *R.* **просо,** prosso, **пшено,** pshenó ; *Arab.* dukhn ; *Pers.* arzun ; *Sans.* kangu, priyangu ; *Hind.* kang ; *Beng.* kungoo ; *Tam.* tenny ; *Cing.* tana-hal ; *Mal.* navaria.

MOHAIR.—*F.* moire ; *It.* cambellotto, panno di peli di camello ; *Sp.* camelote ; *P.* chamalote, melania ; *G.* Mohr, Haartuch ; *Du.* kemelshaar ; *Da.* kameelgarn ; *Sw.* kamlott ; *Gr.* σόφιον τριχίνιον ; *R.* **обьярт,** obyárr, **моръ,** morr.

MOTHER-OF-PEARL.—*F.* nacre de perle ; *It.*, *Sp.* madreperla ; *P.* madreperola ; *G.* Perlenmutter ; *Du.* parelmoer ; *Da.* perlemoor ; *Sw.* perlemor ; *R.* **перломутръ,** perlomútr ; *Pers.*, *Hind.* cheep.

MULE (*Lat.* mulus).—*F.* mulet ; *It.*, *Sp.* mulo ; *P.* macho, mula ; *G.* Maulthier ; *Du.* muilezel ; *Da.* muulæsel ; *Sw.* mulåsna ; *Gr.* μουλάριον ; *R.* **лошакъ, мулъ,** lóshak, mul.

MUSHROOM (*corruption of French*).—*F.* mousseron, champignon ; *It.* fungo ; *Sp.* seta ; *P.* fungo, cogumelo ; *G.* Erdschwamm ; *Du.* paddestoel ; *Da.* champignon, jordsvamp ; *Sw.* svamp, champinjon ; *Gr.* μανιτάριον ; *R.* **грибъ,** ghrīb.

Hosted by Google

MUSK (*Gr.* μόσχος, *through Lat.*).—*F.* musc ; *It.* muschio ; *Sp.* musco, almizcle ; *P.* almiscar ; *G.* Moschus, Bisam ; *Du.* muskus ; *Da.* muscus, desmer ; *Sw.* muskus, desman ; *Gr.* μόσχος ; *R.* **мускусъ**, múskus ; *Arab.*, *Pers.* miskh, muskh ; *Sans.* mooshka, kasturie ; *Hind.* kustooree ; *Tam.* custoori ; *Cing.* rutta ooroola ; *Mal.* jebat ; *Jav.* dedes.

MUSSEL (*Ags.* muscle, muxcle).—*F.* moule ; *It.* nicchio ; *Sp.* almeja ; *P.* mexilhão ; *G.* Muschel ; *Du.* mossel ; *Da.* musling ; *Sw.* mussla ; *Gr.* κόγχλη ; *R.* **ракушка**, rakúshka.

MUSTARD (*Gr. and Lat.* sinapi ; *Arab. through Sp. and Fr.*).—*F.* moutarde ; *It.* senape ; *Sp.* mostaza ; *P.* mostarda ; *G.* Senf ; *Du.* mosterd ; *Da.* senep ; *Sw.* senap ; *Gr.* σινάπιον ; *R.* **горчица**, ghortshītsa ; *Arab.* khirdal ; *Pers.* sirshuff ; *Sans.* sirsūn, rajika ; *Hind.* kalee rai ; *Tam.* kadaghoo ; *Cing.* gan-aba ; *Mal.* sasavie.

MYRRH (*Gr. through Lat.* myrrha).—*F.* myrrhe ; *It.*, *Sp.* mirra ; *P.* mirra, myrrha ; *G.* Myrrhe ; *Du.* mirre ; *Da.*, *Sw.* myrrha ; *Gr.* μυρρα ; *R.* **мирра**, mīrra, **смирна**, smīrna ; *Arab.* murr ; *Hind.* herabole ; *Sans.* vola ; *Tam.* valatipolum, villey bolum, palendra-bolum ; *Mal.* manisan-lebah ; *Jav.* madu.

NAPHTHA (*Gr.*).—*F.* naphte ; *It.*, *Sp.* nafta ; *P.* naphtha ; *G.* Steinöl ; *Du.* naftha ; *Da.* naphta ; *Sw.* nafta ; *Gr.* νάφθα, πετρέλαιον ; *Arab.* neft ; *Sans.* bhumi tailum ; *Hind.* nukteil, mittie-ka-teil ; *Tam.* mun tylum ; *Mal.* minnia tanna.

NICKEL (*Ger.*).—*F.* nickel ; *Sp.*, *P.* niquel ; *G.* Nickel ; *Du.* nikkel ; *Da.*, *Sw.* nickel.

NITRE, SALTPETRE (*Gr.*, *Lat.*).—*F.* nitre ; *It.* nitro, salnitro ; *Sp.*, *P.* nitro ; *P.* salitre ; *G.*, *Du.*, *Da.* Salpeter ; *Sw.* saltpeter ; *Gr.* νίτρον ; *R.* **селитра**, selítra ; *Arab.* ubkir ; *Pers.* shora ; *Sans.* yavakshra ; *Hind.* sooriakhar ; *Tam.* potti-loopoo ; *Cing.* wedie-loonoo ; *Mal.* sandawa, mesiumentah.

NUT (*Ags.* hnut ; *Lat.* nux).—*F.* noix ; *It.* noce ; *Sp.* nuez ; *P.* noz ; *G.* Nuss ; *Du.* noot ; *Da.* nöd ; *Sw.* nöt ; *Gr.* καρύδιον ; *R.* **орѣхъ**, oryêkh.

NUTMEG (Nut-mace ?).—*F.* noix de muscade ; *It.*, *Sp.*, *P.* moscada ; *G.* Muskaten-nuss ; *Du.* nootmuskaat ; *Da.* muskatnöd ; *Sw.* muskot ; *Gr.* μοσχοκάρυδον ; *R.* **мушкатный орѣхъ**, mushkátnyĭ oryékh ; *Arab.* jowz-al-teib ; *Pers.* jowz bewa ; *Sans.* jatiphala ; *Beng.* jaya-phala ; *Hind.* jaiphul ; *Tam.* jadikai ; *Cing.* jatipullum, sadiḳka ; *Mal.* buah-pala ; *Jav.* woh-pala ; *Bali.* bu-wah-pa.

OAK (*Ags.* ác ; *Lat.* quercus, robur).—*F.* chêne ; *It.* quercia ; *Sp.* roble ; *P.* carvalho ; *G.* Eiche ; *Du.* eik ; *Da.* eeg ; *Sw.* ek ; *Gr.* δρύς, βαλανιά ; *R.* **дубъ**, dubb ; *Arab.* baalut.

OATS (*Ags.* áta ; *Lat.* avena).—*F.* avoine ; *It.* vena ; *Sp.* avena ; *P.*

Hosted by Google

avêa ; *G.* Hafer ; *Du.* haver ; *Da.* havre ; *Sw.* hafre ; *Gr.* βρόμιον ; *R.* **овесъ**, ovyóss.

OCHRE (*Gr.* ochra).—*F.* ocre ; *It.* ocra ; *Sp.*, *P.* ocre ; *G.* Ocher, Ocker ; *Du.* oker ; *Da.* okker ; *Sw.* ockra ; *Gr.* ὤχρα ; *R.* **охра**, okhra ; *Hind.*, *Guz.* pewdee (yellow), sonagaroo (red).

OIL (*Ags.* ele, *from Gr.* ἔλαιον ; *Lat.* oleum).—*F.* huile ; *It.* olio ; *Sp.* aceite ; *P.* azeite, oleo ; *G.* Oel ; *Du.*, *Da.* olie ; *Sw.* olja ; *Gr.* λάδιον, ἔλαιον ; *R.* **масло**, masslo ; *Pers.* roghun ; *Hind.* teil.

OLIBANUM (*Arab.*, *Gr.*).—*F.* olibanum ; *It.*, *Sp.*, *P.* olibano ; *G.*, *Du.*, *Da.*, *Sw.* Olibanum ; *Gr.* ὀλίβανον ; *R.* **олибанъ**, oliban ; *Arab.*, *Pers.* luban · *Hind.* koondur zuchir ; *Beng.* gunda barosa ; *Tam.* paranghi sambrani.

OLIVE (*Lat.* oliva).—*F.* olive ; *It.* uliva ; *Sp.* oliva, aceituna ; *P.* azeitona ; *G.* Olive, Oelbeere ; *Du.* olijf ; *Da.*, *Sw.* oliv ; *Gr.* ἔλαια ; *R.* **масличина, олива**, maslītshīna, olīva ; *Arab.*, *Pers.*, *Hind.* zeitoon.

ONION (*Lat.* cepa).—*F.* oignon ; *It.* cipolla ; *Sp.* cebolla ; *P.* cebola ; *G.* Zwiebel ; *Du.* uije, ajuin ; *Da.* lög ; *Sw.* lök ; *Gr.* κρομμύδιον ; *R.* **лукъ**, luk ; *Arab.* bussel ; *Pers.* peeaz ; *Sans.* palandu, latarka, sukundaka ; *Hind.* peeaz ; *Guz.* kẖanda, peeaz ; *Tam.* venggayum ; *Cing.* loono ; *Mal.* bavangmira ; *Jav.* brang-bang.

ONYX (*Gr.* ὄνυξ).—*F.* onyx ; *It.* onice ; *Sp.* onique, oniz ; *P.* onyx ; *G.* Onyx, Onychstein ; *Du.*, *Da.* onyx ; *Sw.* onix ; *R.* **оникъ**, oniks.

OPAL (*Lat.* opalus).—*F.* opale ; *It.*, *Sp.* opalo ; *P.* opala ; *G.* Opal ; *Du.* opaal ; *Da.*, *Sw.* opal ; *R.* **опалъ**, opáll.

OPIUM (*Lat.*).—*F.* opium ; *It.* oppio ; *Sp.*, *P.* opio ; *G.* Opium, Mohnsaft ; *Du.* opium ; *Da.* opium, valmuesaft ; *Sw.* opium, vallmosaft ; *Gr.* ὄπιον, ʼαφιώνιον ; *R.* **маковый сокъ, опіумъ**, mákovyĭ sok, opium ; *Turk.* majoon ; *Arab.* ufyoon ; *Pers.* ufyoon, sheer-i-kush-khush ; *Sans.* chasa, apaynum ; *Hind.* ufyoon, ufeem ; *Tam.* apini ; *Cing.* abim ; *Mal.* ufyoon, caruppa ; *Jav.* apium ; *Bali*, hapium.

ORANGE (*Lat.* aurantium).—*F.* orange ; *It.* arancia ; *Sp.* naranja ; *P.* laranja ; *G.* Apfelsine, Orange ; *Du.* oranje ; *Da.* apelsin, pomerands ; *Sw.* apelsin, orange, pomerans ; *Gr.* νεράντζιον ; *R.* **оранія, померанецъ**, orániya, pomeránets ; *Pers.* narungee ; *Sans.* naga-runga ; *Hind.* narunghie ; *Tam.* kichlie-pullum, collungie pullum ; *Cing.* panneh dodang ; *Mal.* simao manis.

ORCHILL, ARCHIL.—*F.* orseille ; *It.* orcella, oricello ; *Sp.* orchilla ; *P.* orsella ; *G.* Orseille ; *Du.* purpermos ; *Sw.* orselj, orsilja.

ORPIMENT, YELLOW, SULPHURET OF ARSENIC (*Lat.* auri pigmentum, *golden pigment*).—*F.* orpiment ; *It.* orpimento ; *Sp.* oropimente ;

Hosted by Google

P. ourópimente; *G.* Orpement, Rauschgelb; *Du.* oprement; *Da.*, *Sw.* auripigment (arsenik blandet med svovl); *R.* **опермент**ъ, operménт, **желтый мышьяк**ъ, zholtyĭ myshyáck; *Arab.* ursanikoon; *Pers.* zerneik-zurd; *Sans.* haritalaka; *Hind.* hurtal; *Tam.* aridurum, yelliekood-pashanum.

OSTRICH (*Lat.* avis struthio).—*F.* autruche; *It.* struzzo; *Sp.* avestruz; *P.* abestruz; *G.* Strauss; *Du.* struisvogel; *Da.* strudsfugl; *Sw.* struts; *Gr.* στρουθοκάμηλος; *R.* **строусъ**, stróüss.

OYSTER (*Gr. through Lat.*).—*F.* huître; *It.* ostrica; *Sp.*, *P.* ostra; *G.* Auster; *Du.* oester; *Da.* östers; *Sw.* ostron, ostra; *Gr.* ὀστρίδιον; *R.* **устрица**, ústrītsa; *Hind.*, *Guz.* kaloo.

PALM (*Lat.* palma).—*F.* palmier; *It.*, *Sp.*, *P.* palma; *G.* Palme; *Du.* palm; *Da.* palme (træ); *Sw.* palm; *Gr.* φοινικιά; *R.* **палма**, palma.

PARSNIP (*corruption of* pastnik, *from Lat.* pastinaca).—*F.* panais; *It.* pastinaca; *Sp.* chirivía; *P.* cenoura branca; *G.* Pastinake; *Du.*, *Da.* pastinak; *Sw.* palsternacka; *Gr.* καβούτζιον; *R.* **пастернак**ъ, pasternák.

PEAR (*Ags.* peru; *Lat.* pyrum).—*F.* poire; *It.*, *Sp.*, *P.* pera; *G.* Birne; *Du.* peer; *Da.* pære; *Sw.* päron; *Gr.* ἀπίδιον; *R.* **груша**, ghrusha.

PEARL (*Ags.* pærl).—*F.* perle; *It.*, *Sp.* perla; *P.* perola; *G.* Perle; *Du.* parel; *Da.* perle; *Sw.* perla; *Gr.* μαργιτάριον; *R.* **жемчужина**, zhemtshúzhina, **перла**, perla; *Arab.* lulu; *Pers.* murwareed; *Hind.* moothee; *Tam.* motu; *Cing.* mutu.

PEASE (*Ags.* pise; *Lat.* pisum).—*F.* pois; *It.* piselli; *Sp.* guisantes; *P.* ervilhas; *G.* Erbsen; *Du.* erwten; *Da.* ærter; *Sw.* ärter; *Gr.* ἀρακᾶς, πίζα; *R.* **горохъ**, ghorókh; *Pers.* kirseneh; *Sans.* harenso; *Hind.* wuttana; *Tam.* puttanie.

PEAT.—*F.* tourbe; *It.*, *Sp.* turba; *P.* terra combustivel; *G.* Torf, Braunkohle; *Du.* turf; *Da.* törv; *Sw.* torf; *Gr.* μαυρολάχανον; *R.* **торфъ**, torph.

PEPPER, BLACK (*Ags.* pipor, *from Lat.* piper).—*F.* poivre; *It.* pepe nero; *Sp.* pimienta; *P.* pimenta; *G.* Pfeffer; *Du.* peper; *Da.* peber; *Sw.* peppar; *Gr.* πιπέρι; *R.* **перецъ**, pérets; *Arab.* fiffil uswood; *Pers.* fiffil-i-seeah; *Sans.* maricha; *Hind.* kalamirree, gool-mirch; *Tam.* mellaghoo; *Cing.* gammiris; *Mal.* lada; *Jav.* maricha; *Bali*, micha; *Palembang*, sahan.

PEPPER, CAYENNE. See CAPSICUM.

PEPPER, JAMAICA. See PIMENTO.

PEPPER, LONG.—*F.* poivre long; *It.* pepe lungo; *Sp.* pimenta larga; *P.* pimenta longa; *Ger.* Lange Pfeffer; *Du.* lange peper, staartpeper; *Arab.* dar-fiffil; *Pers.* fiffill-i-daraz; *Sans.* pippali krishna; *Hind.* pepeelee; *Tam.* tipili; *Cing.* tipili; *Mal.* tabee.

Hosted by Google

PHOSPHORUS (*Gr.* light bearing). — *F.* phosphore ; *It.*, *Sp.* fosforo ; *P.* phosphoro ; *G.* Phosphor ; *Du.* phosphorus ; *Da.* phosphor ; *Sw.* fosfor ; *Gr.* *φώσφορος* ; *R.* **фосфоръ**, phosphor, **свѣтоносъ**, svyêtonoss.

PILCHARD, SARDINE. — *F.* sardine ; *It.* saracca ; *Sp.* sardina ; *P.* sardinha ; *G.* Pilscher, Sardelle ; *Du.* sardijn ; *Da.* sardine, sardelle ; *Sw.* sardin, sardell ; *Gr.* *σάρδα*, *σαρδέλλα* ; *R.* **сарделъ**, **салакушка**, sardyoll, salakushka.

PIMENTO, ALLSPICE, JAMAICA PEPPER. — *F.* piment, poivre de Jamaïque ; *It.* pimenta, pepe garofanato ; *Sp.* pimienta de la Jamaica ; *P.* pimenta du Jamaica ; *G.* Piment, Jamaica Pfeffer, Nelken Pfeffer ; *Du.*, *Da.* piment ; *Sw.* kryddpeppar ; *R.* **Англійскій перецъ**, ángliĭskiĭ pérets.

PINE (*Lat.* pinus).—*F.* pin ; *It.*, *Sp.* pino ; *P.* pinheiro ; *G.* Fichte ; *Du.* pijn ; *Da.*, *Sw.* gran ; *Gr.* *πεύκη* ; *R.* **сосна**, sosna.

PINE APPLE (*Peruv.* nanas—*first seen by Europeans in Peru in the sixteenth century*).—*F.* ananas ; *It.* annanasso ; *Sp.* anana ; *P.* ananás ; *G.* Ananas ; *Du.* pijnappel ; *Da.*, *Sw.* ananas ; *Gr.* *ἀνανάς* ; *R.* **ананасъ**, ananáss ; *Hind.* annanas ; *Tam.* anasiepullum ; *Cing.* anasi ; *Mal.* nanas-naneh.

PISTACHIO (*Pers.* pistak, *through Gr.*, *Lat.*, *and It.*).—*F.* pistache ; *It.* pistacchio ; *Sp.* pistacho, alfoncigos ; *P.* fistica, pistacha ; *G.* Pistazie ; *Du.* pistachenoot ; *Da.* pistasie ; *Sw.* pistacie ; *Gr.* *πιστάκιον* ; *R.* **фисташка**, fistáshka ; *Hind.* pistach.

PITCH (*Ags.* pic ; *Lat.* pix).—*F.* poix ; *It.* pece ; *Sp.*, *P.* pez ; *G.* Pech ; *Du.* pek, pik ; *Da.* beg ; *Sw.* beck ; *Gr.* *πίσσα* ; *R.* **смола**, smola ; *Hind.* pitch.

PLANTAIN.—*F.* plantain ; *Sp.* platano ; *P.* plantano ; *G.* Pisang, Paradiesfeige ; *Du.* pisang ; *Da.*, *Sw.* pisang ; *R.* **попутникъ**, popútnik ; *Sans.* kudali ; *Hind.* kayla ; *Tam.* valiepullum ; *Cing.* kehlkang ; *Mal.* pesang.

PLATINA (*Sp.* plata, *silver*).—*F.* platine ; *It.*, *Sp.*, *P.* platina ; *G.* Platin ; *Du.*, *Da.*, *Sw.* platina ; *R.* **платина**, platīna

PLUM (*Ags.* plume ; *Lat.* prunum).—*F.* prune ; *It.* prugna, susina ; *Sp.* ciruela ; *P.* ameixa ; *G.* Pflaume ; *Du.* pruim ; *Da.* blomme, svedske ; *Sw.* plommon ; *Gr.* *δαμάσκηνον* ; *R.* **слива**, slīva.

PLUMBAGO, BLACK LEAD (*Lat.*).—*F.* plombagine, potelot ; *It.* piombaggine, tocca lapis ; *Sp.* lapiz plomo, carbureto de hierro ; *P.* lapis ; *G.* Reissblei, Pottloth ; *Du.* potlood ; *Da.* blyant ; *Sw.* Engelsk blyerts ; *R.* **черный карандашъ**, tshernyĭ karandásh.

POMEGRANATE (*Lat.* pomum granatum, *an apple of grains*). — *F.* grenade ; *It.* mela grana ; *Sp.* granada ; *P.* romãa, roman ; *G.* Granatapfel ; *Du.* granaatappel ; *Da.* granatæble ; *Sw.* granatäple ;

Hosted by Google

Gr. ροΐδιον; *R.* **гранатъ**, granát; *Turk.* nar; *Arab.* rana, rooman; *Pers.* anaar; *Sans.* dadima; *Hind.* anaar, darim; *Tam.* magilum palam; *Cing.* delunghidie; *Mal.* dalema.

POPLAR (*Lat.* populus).—*F.* peuplier; *It.* pioppo; *Sp.* alamo; *P.* choupo, álemo; *G.* Pappel; *Du.* populier; *Da.* poppeltræ; *Sw.* poppelträd; *Gr.* λέυκη ἄιγειρος; *R.* **осина**, osīna.

POTASH.—*F.* potasse; *It.* potassa; *Sp.* potasa; *P.* potassa; *G.* Pottasche; *Du.* potasch; *Da.* potaske; *Sw.* pottaska; *R.* **сѣрый поташъ**, syêryĭ potásh; *Hind.* jowkshar; *Tam.* maraoopoo.

POTATO (*from S. American* batata, *the sweet potato, known in Europe before the plant now called potato, which was confounded with it at first erroneously*).—*F.* patate, pomme de terre; *It.* patata; *Sp.* patata; *P.* batata; *G.* Kartoffel; *Du.* aardappel; *Da.* kartoffel; *Sw.* potates, jordpäron; *Gr.* γαιόμηλον; *R.* **картофель**, kartófel'; *Pers.* aloo; *Hind.* aloo, puttata; *Tam.* wallarai kilangoo; *Cing.* ruta innala.

POULTRY (*Fr.*).—*F.* volaille; *It.* pollame; *Sp.* aves de corrál; *P.* aves domesticas; *G.* Geflügel; *Du.* gevogelte; *Da.* höns, fiederkræ; *Sw.* fjäderfä; *Gr.* πουλερά; *R.* **куры**, kury.

PUMICE (*Lat.* pumex).—*F.* pierre ponce; *It.* pomice; *Sp.* piedra pómez; *P.* pedra pomes; *G.* Bimstein; *Du.* puimsteen; *Da.* pimpsteen; *Sw.* pimpsten; *Gr.* κίσσηρις; *R.* **пемза**, pemza.

QUINCE (*Fr.* coings).—*F.* coing; *It.* mela cotogna; *Sp.* membrillo; *P.* marmelo; *G.* Quitte; *Du.* kwepeer; *Da.* qvæde; *Sw.* qvitten; *Gr.* κυδώνιον; *R.* **айва**, aĭvá; *Arab.*, *Pers.*, *Hind.*, *Tam.* behdana.

RAISINS (*Fr.* grapes).—*F.* raisins secs; *It.* uve passe; *Sp.* pasas, uvas secas; *P.* passas de uva; *G.* Rosinen; *Du.* rozijnen; *Da.* Rosiner; *Sw.* russin; *Gr.* σταφίδαι; *R.* **изюмины**, īzyúmīny; *Hind.* darakh, mowage.

RAPE (*Lat.* rapa).—*F.* râpe; *It.* rapa; *Sp.* nabina; *P.* nabiça; *G.* Rübsen, Rübsamen; *Du.* raap; *Da.* raps; *Sw.* rapsat; *R.* **колраби**, kolrábī; *Hind.* sursee, surrus.

RASPBERRY.—*F.* framboise; *It.* mora di rovo; *Sp.* frambuesa; *P.* frambesia; *G.* Himbeere; *Du.* flamboos; *Da.* hindbær; *Sw.* hallon; *Gr.* σμέουρον; *R.* **малина**, malīna.

RESIN (*Lat.* resina).—*F.* résine; *It.* ragia, resina; *Sp.*, *P.* resina; *G.* Harz; *Du.* hars; *Da.* harpix; *Sw.* harts, kåda; *Gr.* ρετζίνη, ἀραζίνη; *R.* **камедь**, kaméd'.

RHUBARB (*Lat.* rha, *and* barba).—*F.* rhubarbe; *It.* reubarbaro; *Sp.* ruibarbo; *P.* rhuibarbo; *G.* Rhabarber; *Du.* rabarber; *Da.* rhabarber; *Sw.* rabarber; *Gr.* ραβέντιον; *R.* **ревень**, revén'; *Arab.*, *Pers.* rawund; *Hind.* rawunchenee; *Tam.* variattoo kalang.

Hosted by Google

RICE (*Gr. through Lat.* oryza).—*F.* riz; *It.* riso; *Sp.*, *P.* arroz; *G.* Reis; *Du.* rijst; *Da.* riis; *Sw.* ris; *Gr.* ὄρυζα; *R.* **рисъ**, rīss, **сарачинское пшено**, saratshīnskoë pshenó; *Arab.* aruz; *Pers.* berung; *Hind.* chawl; *Guz.* chooka; *Sans.* vrihi; *Tam.* arisee; *Mal.* bras.

ROSE (*Lat.* rosa).—*F.* rose; *It.*, *Sp.*, *P.* rosa; *G.* Rose; *Du.* roos; *Da.*, *Sw.* rose; *Gr.* ρόδον; *R.* **роза**, rozá; *Arab.* wurd; *Pers.*, *Hind.*, *Guz.*, *Beng.* gul; *Tam.* gulaba poo; *Mal.* mawar.

RUBY (*from Lat.* ruber, *red*).—*F.* rubis; *It.* rubino; *Sp.* rubí; *P.* rubim; *G.* Rubin; *Du.* robijn; *Da.*, *Sw.* rubin; *Gr.* ρουμπίνιον; *R.* **лалъ**, lall, **рубинъ**, rubīn.

RYE (*Ags.* ryge; *Lat.* secale).—*F.* seigle; *It.* segala; *Sp.* centeno; *P.* senteio, centêo; *G.* Roggen; *Du.* rogge; *Da.* rug; *Sw.* råg; *Gr.* βρίζα, σεκάλη; *R.* **рожь**, rozh'.

SABLE (*Russ.*).—*F.* sable; *It.* zibellino; *Sp.* cebellina; *P.* zibelina; *G.* Zobel; *Du.* sabel; *Da.* zobel; *Sw.* sobel; *Gr.* σαμόυριον; *R.* **соболь**, sóbol'.

SAFFLOWER.—*F.* carthame, saffran bâtard; *It.* zaffrone; *Sp.* azafran bastardo; *P.* açafroa; *G.* Safflor; *Du.* saffloer, basterd saffraan; *Da.*, *Sw.* safflor; *Arab.* usfar; *Sans.* kussumba, kuma lottora; *Beng.* koosum, kajeera; *Hind.*, *Mal.* kussumba; *Tam.* sendorkum.

SAFFRON (*Arab.* ssafrā, *yellow, through Spanish*).—*F.* safran; *It.* zafferano; *Sp.* azafran; *P.* açafrão; *G.* Saffran; *Du.* saffraan; *Da.* saffran; *Sw.* saffran; *Gr.* κρόκος; *R.* **шафранъ**, shafránn; *Arab.* zaifran; *Pers.* abeer, kurkam; *Hind.* keysur, zaifran; *Sans.* kasmira janma, kunkama; *Tam.* khoon goomapoo; *Cing.* khohoon; *Mal.* safaron.

SAGO.—*F.* sagou; *It.* sagu; *Sp.* sagú; *P.* sagu; *G.*, *Du.*, *Da.*, *Sw.* Sago; *R.* **саго**, sagho; *Hind.* sagoo, sagoo-chawl; *Tam.* show-arisee; *Beng.* sagoodana; *Mal.*, *Jav.*, *Bali*, sagu; *Chin.* sekuhme.

SAL-AMMONIAC, MURIATE OF AMMONIA.—*F.* sel ammoniac; *It.* sale ammoniaco; *Sp.* amoniáco, sal amoniáca; *P.* sal ammoniaco; *G.* Salmiak; *Du.* ammoniak zout; *Da.*, *Sw.* salmiak; *Gr.* ἀμμονιακός; *R.* **нашатыръ**, nashatýr; *Arab.* urmena; *Pers.* nowshadur; *Sans.* nowsadur; *Hind.*, *Guz.* nowsadur, nowsagur; *Tam.* navacharum; *Cing.* vayvagarra loonoo.

SALMON (*Lat.* salmo).—*F.* saumon; *It.* salmone; *Sp.* salmon; *P.* salmão; *G.* Salm, Lachs; *Du.* zalm; *Da.*, *Sw.* lax; *Gr.* σαλμών; *R.* **семга**, sémgha.

SALT (*Ags.* sealt; *Lat.* sal).—*F.* sel; *It.* sale; *Sp.* sal; *P.* sal; *G.* Salz; *Du.* zout; *Da.* salt; *Sw.* salt; *Gr.* ἅλας; *R.* **соль**, sol'; *Arab.* melh; *Pers.* nun, shora; *Sans.* lavana; *Hind.* neemuck; *Tam.* oopoo; *Cing.* loonoo; *Mal.* gharam; *Jav.* uyah.

Hosted by Google

SAND (*Ags.* sand; *Lat.* arena).—*F.* sable; *It.* arena; *Sp.* **arena**; *P.* areia; *G.* Sand; *Du.* zand; *Da.*, *Sw.* sand; *Gr.* ἄμμος; *R.* **песокъ**, pesók.

SANDALWOOD, SANDERS (*Arab.* ssandal; *Lat.* santalum, sandalum).—*F.* santal; *It.*, *Sp.*, *P.* sandalo; *G.* Sandelholz; *Du.* sandelhout; *Da.* sandeltræ; *Sw.* sandelträd; *Gr.* κοκκινόξυλον; *R.* **сандалое дерево**, sandáloë dérevo; *Arab.*, *Pers.* sundul; *Hind.*, *Guz.* sundul, sookur; *Sans.* chandana Malayaja; *Beng.* chandana; *Tam.* chandanum; *Cing.* sandoon; *Mal.* Tsjendana; *Chin.* tan-muh.

SAPPHIRE (*Heb. and Arab.* ssaphīr, *through Gr. and Lat.*).—*F.* saphir; *It.* zaffiro; *Sp.* zafir; *P.* safira; *G.* Sapphir; *Du.* saffier; *Da.* saphir; *Sw.* safir; *Gr.* σαφείριον, ζαφίριον; *R.* **сапфиръ**, sapfīr.

SARSAPARILLA.—*F.* salsepareille; *It.* salsapariglia; *Sp.* zarzaparilla; *P.* sarsaparrilha; *G.* Sarsaparillo, Sassaparille; *Du.* sarsaparille; *Da.*, *Sw.* sassaparill; *Gr.* σαπαρίνα; *R.* **сассапарилъ**, sassaparíll; *Arab.* muckwy; *Sans.* shariva; *Tam.* nunnarivayr; *Cing.* erra-masoomul, irimusa.

SCAMMONY (*Gr. through Lat.*).—*F.* scammonée; *It.* scammonea; *Sp.*, *P.* escamonéa; *G.* Scammonie, Purgirwinde; *Du.*, *Da.*, *Sw.* Scammonium; *Gr.* σκαμμωνία; *R.* **песья смерть**, pessya smert'; *Arab.*, *Hind.* sukmoonia.

SEAL (*Ags.* seol, seolh; *Lat.* phoca).—*F.* veau marin; *It.* vitello marino; *Sp.* foca; *P.* phoca; *G.* Seehund, Seekalb; *Du.* zeehond; *Da.* sæl(hund); *Sw.* själhund, sjökalf; *Gr.* φώκη; *R.* **тюлень**, tyulen'.

SENNA (*Arab.*).—*F.* séné; *It.*, *Sp.* sena, sen; *P.* sene, senne; *G.* Senespflanze; *Du.* zenebladen; *Da.* sennesblade; *Sw.* sennesblad; *R.* **Александрійскій листъ**, Aleksándriĭskiĭ līst, *i.e.*, Alexandrian leaf; *Arab.* suna; *Sans.* butallapotaka; *Beng.* sana-pat; *Hind.* soonamukee; *Tam.* nilaverei, nilavaghei; *Cing.* nilaverei.

SHAMMEY, or CHAMOIS.—*F.* chamois; *It.* camozza; *Sp.* gamuza; *P.* camurça; *G.* Gemse; *Du.* gems; *Da.* steenged (simslæder); *Sw.* stenget (s-läder); *Gr.* ἀγρίογιδα; *R.* **серна**, **замша**, serna, zamsha.

SHEEP (*Ags.* sceap; *Lat.* ovis, pecus).—*F.* brebis; *It.* pecora; *Sp.* oveja; *P.* carneiro; *G.* Schaf; *Du.* schaap; *Da.* faar; *Sw.* får; *Gr.* πρόβατον; *R.* **овца**, ovtsá.

SHRIMP (*Ger.* schrumpfen, *to shrivel*).—*F.* chevrette; *It.* squilla; *Sp.* camaron; *P.* camarão; *G.* Garnele; *Du.* garnaal; *Da.* reie; *Sw.* räka; *R.* **морской рачекъ**, morskóĭ ratshók.

SILK (*Ags.* seolc, *comp. Da. and Sw.*).—*F.* soie; *It.* seta; *Sp.*, *P.* seda; *G.* Seide; *Du.* zijde; *Da.* silke; *Sw.* silke, siden; *Gr.*

Hosted by Google

μέταξα; *R.* **шелкъ,** sheólk; *Pers.* ab-rashum; *Hind.* rasum, rashum.

SILVER (*Ags.* seolfer; *Lat.* argentum; *Celtic*, airgiod).—*F.* argent; *It.* argento; *Sp.* prata; *P.* plata; *G.* Silber; *Du.* zilver; *Da.* sölv; *Sw.* silfwer; *Gr.* ἀργύριον; *R.* **серебро,** serebró; *Arab.* fazzeh; *Pers.* nokra; *Sans.* rajata, rupya; *Hind.* nugdee, chandee; *Tam.* vellie; *Cing.* peddie; *Mal.* perak; *Chin.* yin.

SKINS (*Ags.? Da.*).—*L.* pelles; *Fr.* peaux; *It.* pelli; *Sp.* pieles; *P.* pelles; *G.* Felle; *Du.* vellen; *Da.* skind; *Sw.* skinn; *Gr.* δέρματα, πέτζια; *R.* **кожи,** kózhī; *Pers.* churm; *Hind.* chumra; *Guz.* chamro.

SLATE (*F.* éclat; *Old Fr.* esclat, *a splinter, a split*).—*F.* ardoise; *It.* lavagna; *Sp.* pizarra; *P.* ardosia; *G.* Schiefer; *Du.* lei; *Da.* skifersteen; *Sw.* skifersten; *Gr.* ἀρδωσία; *R.* **аспидъ,** áspīd.

SLAVE (*Ags.* wealh, *a Welshman; Ger.* Sklave, *a Slavonian; Lat.* servus, *a Servian*).—*F.* esclave; *It.* schiavo; *Sp.* esclavo; *P.* escravo; *G.* Sklave; *Du.* slaaf; *Da.* slave; *Sw.* slaf; *Gr.* σκλάβος, δοῦλος; *R.* **неволникъ,** nevólnīk (*i.e.*, an involuntary).

SNOW (*Ags.* snáw; *Lat.* nix, *orig.* snix, snivis).—*F.* neige; *It.* neve; *Sp.* nieve; *P.* neve; *G.* Schnee; *Du.* sneeuw; *Da.* snee; *Sw.* snö; *R.* **снѣгъ,** snyêgh.

SOAP (*Ags.* sápe; *Lat.* sapo).—*F.* savon; *It.* sapone; *Sp.*, jabon; *P.* sabão; *G.* Seife; *Du.* zeep; *Da.* sæbe; *Sw.* tvål, sâpa; *Gr.* σαπούνιον; *R.* **мыло,** mylo; *Arab.*, *Hind.*, *Mal.* saboon; *Tam.* natsowcaram.

SODA (*Ger.*).—*F.* soude; *It.*, *Sp.*, *P.* soda; *G.* Aetznatron, Soda; *Du.*, *Da.*, *Sw.* soda; *R.* **сода,** soda; *Arab.* jumdchenee; *Pers.* sajee-khar, papud-khar; *Hind.* sedjee-mittee, sajeekhar, papud-khar; *Sans.* sarjica, sarjikashara; *Tam.* karum, ponheer karum; *Mal.* charum.

SPERMACETI (*Lat.*, *i.e.*, sperm of the whale).—*F.* blanc de baleine; *It.* bianco di balena; *Sp.* espermaceti; *P.* espermacete; *G.* Wallrath; *Du.* spermaceti; *Da.* hvalrav; *Sw.* hvalrafs-olja; *R.* **китовыи жиръ,** kītóvyĭ zhīr.

SPICES.—*F.* épices, épiceries; *It.* spezj, spezierie; *Sp.* especias, especerias; *P.* especiaria; *G.* Spezereien; *Du.* specerijen; *Da.* speceri, kryderi; *Sw.* speceri, krydda; *Gr.* ἀρώματα, πακαλικά; *R.* **пряные коренъа,** pryányе kórenya, **пряноxранилише,** pryano khranílishtshe; *Hind.*, *Guz.* gurm mussala.

SPONGE (*Ags.* spinge, *from Lat.* spongia).—*F.* éponge; *It.* spugna; *Sp.*, *P.* esponja; *G.* Schwamm; *Du.* spons; *Da.*, *Sw.* svamp; *Gr.* σφουγγάριον; *R.* **губка,** ghubka; *Arab.* isfeng; *Pers.* abermoordeh; *Hind.* mooabadul.

Hosted by Google

SQUILL (*Lat.* scilla).—*F.* oignon de mer; *It.* cipolla squilla; *Sp.* cebolla albarrana; *P.* scilla; *G.* Meerzwiebel; *Du.* zeeajuin; *Da.* sölög; *Sw.* hafslök; *R.* **морской лукъ,** morskóĭ luk (=sea-onion).

STARCH (*Ags.* steare, *stiff; Gr.* ἄμυλον; *Lat.* amylum).—*F.* amidon; *It.* amido; *Sp.* almidon; *P.* gomma de trigo; *G.* Stärke; *Du.* stijfsel; *Da.* stivelse; *Sw.* stärkelse; *Gr.* ἄμυλον, *κατασταθς*; *R.* **крахмалъ,** krakhmáll; *Arab.* abgoon; *Pers.* neeshashta.

STEEL (*Ags.* stýl).—*F.* acier; *It.* acciajo; *Sp.* acero; *P.* aço; *G.* Stahl; *Du., Da.* staal; *Sw.* stål; *Gr.* χάλυψ, *τζελίκιον*; *R.* **сталь,** stal'; *Pers., Hind.* foulad'.

STONE (*Ags.* stán; *Lat.* lapis, petra, *from Gr.* πετρα).—*F.* pierre; *It.* pietra; *Sp.* piedra; *P.* pedra; *G.* Stein; *Du.* steen; *Da.* steen; *Sw.* sten; *Gr.* πέτρα, λίθος; *R.* **камень,** kámen'.

STRAW (*Ags.* streow; *Lat.* palea, *chaff*).—*F.* paille; *It.* paglia; *Sp.* paja; *P.* palha; *G.* Stroh; *Du.* stroo; *Da.* straa; *Sw.* strå; *Gr.* ἄχυρα; *R.* **солома,** soloma.

STURGEON (*Lat.* sturio).—*F.* esturgeon; *It.* storione; *Sp.* esturion; *P.* robalo; *G.* Stör; *Du.* steur; *Da., Sw.* stör; *Gr.* ξυρύχιον, μουρούνα; *R.* **осетръ,** osétr.

SUGAR (*Lat.* saccharum; *Gr.* σάκχαρον, *from Heb. and Arab.* ssakhar; "the honey got from reeds called σάκχαρι," *Pliny*).—*F.* sucre; *It.* zucchero; *Sp.* azúcar; *P.* assucar, açucar; *G.* Zucker; *Du.* suiker; *Da.* sukker; *Sw.* socker; *Gr.* ζάχαρη; *R.* **сахаръ,** sakhar; *Arab.* sukkur; *Pers.* shakur; *Hind.* shukar; *Sans.* sarkara; *Tam.* sakkara; *Mal.* goola.

SULPHUR, or BRIMSTONE (*Lat.* sulphur).—*F.* souffre; *It.* zolfo; *Sp.* azufre; *P.* enxofre; *G.* Schwefel; *Du.* zwavel; *Da.* svovl; *Sw.* svafvel; *Gr.* θειάφιον; *R.* **сѣра,** syêra; *Arab.* kibreet; *Pers.* gowgird; *Sans.* gandhaka; *Hind.* gunduck; *Tam.* gendagum; *Cing.* gundaka; *Mal.* blerong; *Chin.* lew.

SUMACH (*Pers.*).—*F.* sumac; *It.* sommaco; *Sp.* zumaque; *P.* sumagre; *G.* Sumak, Sumach; *Du.* smak; *Da., Sw.* sumak; *Arab.* tumtum; *Pers.* shūmakh.

TALC (*Germ*).—*F.* talc; *It., Sp., P.* talco; *G.* Talk; *Du.* talkaarde; *Da.* talk (steen); *Sw.* talk; *Gr.* μαρκάσιον; *R.* **талкъ,** talk, **мыловка,** mylovka; *Arab.* kobuk-al-arz; *Pers.* tulk; *Sans.* abraka; *Hind.* abruck, tulk; *Tam.* appracum; *Cing.* minirum.

TALLOW (*Ags.* tealh; *Lat.* seba).—*F.* suif; *It.* sego, sevo; *Sp., P.* sebo; *G.* Talg; *Du.* talk; *Da.* tælle, talg; *Sw.* talg; *Gr.* ὀξύγγιον, στέαρ; *R.* **сало,** salo; *Arab.* shahum; *Pers.* peeh; *Sans.* govapa; *Hind.* churbee; *Tam.* maat kolupoo; *Cing.* hurruk-tail; *Mal.* lemakchair.

TAMARIND (*Pers., Gr. through Lat.* Tamarindus).—*F.* tamarin; *It., Sp.,*

Hosted by Google

P. tamarindo ; *G.*, *Du.*, *Da.* Tamarinde ; *Sw.* tamarinder ; *Gr.* ταμάρινδος ; *R.* **тамариндъ**, tamarīnd ; *Arab.* umblie ; *Turk.* demer-hindee ; *Fers.* Tumr-i-hindee, *i.e.*, date of India ; *Sans.* amlika, tintili ; *Hind.*, *Guz.* amblee ; *Tam.* poollie ; *Cing.* mahasi-ambala ; *Mal.* neghka ; *Jav.* kamal.

TAR (*Ags.* tearo, tyro).—*F.* goudron ; *It.* pece liquida, catrame ; *Sp.* brea ; *P.* alcatrão ; *G.* Theer ; *Du.* teer ; *Da.* tiære ; *Sw.* tjära ; *Gr.* κατράνη ; *R.* **деготь**, dyóghot.

TEA (*Chinese*, Cha, te).—*F.* thé ; *It.* tè ; *Sp.* té ; *P.* chá ; *G.* Thee ; *Du.* thee ; *Da.* thee ; *Sw.* te ; *Gr.* τέϊ, τζάϊ ; *R.* **чай**, tchaï ; *Turk.* tchai ; *Arab.*, *Pers.* chai ; *Hind.* cha, cha-ie ; *Mal.* teh.

TIMBER (*Ags.* timbrian, *to build ; Lat.* materia).—*F.* bois de charpente ; *It.* legname ; *Sp.* madera ; *P.* madeira ; *G.* Bauholz ; *Du.* timmer-hout ; *Da.* tömmer ; *Sw.* timmer ; *Gr.* ξυλέια ; *R.* **строевой лѣсъ**, stroevóï lyêss.

TIN (*Lat.* stannum).—*F.* étain ; *It.* stagno ; *Sp.* estaño ; *P.* estanho ; *G.* Zinn ; *Du.* tin ; *Da.* tin ; *Sw.* tenn ; *Gr.* καλάϊον ; *R.* **жесть**, zhest' ; *Arab.* resas, abruz ; *Pers.* uzeez ; *Sans.* trapu ; *Hind.* kullae, ranga ; *Tam.* tagarum ; *Mal.* tima, falagh ; *Chin.* yang-seih.

TOBACCO (*Native Amer.*).—*F.* tabac ; *It.* tabacco ; *Sp.*, *P.* tabaco ; *G.* Taback ; *Du.* tabak ; *Da.*, *Sw.* tobak ; *Gr.* ταμπάκος ; *R.* **табакъ**, tabák ; *Arab.* bujjerbhang, tutun ; *Turk.* tutun, dokhan ; *Pers.* tumbackoo ; *Sans.* dhumrapatra ; *Hind.* tumbakoo ; *Tam.* pog-heielley ; *Cing.* doon-kola ; *Mal.* tambracco ; *Jav.* tambroca ; *Chin.* sang-yen.

TORTOISE (*Lat.* tortum, *a warlike engine with pent roof, a tortoise*—testudo).—*F.* tortue ; *It.* testuggine, tartaruga ; *Sp.* tortúga ; *P.* tartarugo, cágado ; *G.* Schildkröte, *i.e.*, *a shield-toad ; Du.* schildpad ; *Da.* skildpadde ; *Sw.* sköldpadda ; *Gr.* ἀχελώνα ; *R.* **черепаха**, tsherepákha ; *Hind.* kachakra ; *Mal.* kurakura.

TRUFFLE.—*F.* truffe ; *It.* tartufo ; *Sp.* criadillas de tierra ; *P.* turbara da terra ; *G.* Trüffel ; *Du.* truffel ; *Da.* tröffel, svinerod ; *Sw.* tryffel ; *Gr.* 'υδνον ; *R.* **трюфель**, triouphel'.

TURMERIC (*Lat.* curcuma).—*F.* safran des Indes ; *It.* turtumaglio ; *Sp.*, *P.* curcuma ; *G.* Gelbwurz ; *Du.* kurkuma ; *Da.* spansk saffran ; *Sw.* gurkmeja ; *Gr.* κιτρινοκόκκινος ; *R.* **желтакъ**, zheltak, **желтый нибирь**, zheóltyĭ nibír' ; *Arab.* tumr, zur-sood ; *Pers.* zurd-choobeh ; *Sans.* haridra ; *Hind.* hullud, huldee ; *Tam.* munjil ; *Mal.* mangellacua.

TURNIP (*Ags.* næpe ; *from Lat.* napus ; Turnip, *from* turbo napus ?).—*F.* navet ; *It.* rapa ; *Sp.*, *P.* nabo ; *G.* Rübe ; *Du.* raap, knol ; *Da.* Roe, hvidroe ; *Sw.* rofwa ; *Gr.* γογγύδα ; *R.* **рѣпа**, ryêpá.

Hosted by Google

TURPENTINE (*Gr. through Lat.* Terebinthus).—*F.* térébenthine; *It.*, *Sp.*, *P.* trementina; *G.* Terpentin; *Du.* terpentijn; *Da.*, *Sw.* terpentin; *Gr.* τερεβίνθος; *R.* **терпентинъ**, terpentín, **скипидаръ**, skīpīdárr; *Arab.* ratenuj-roomie, butum; *Pers.* zungbarie; *Hind.* turpentine.

ULTRAMARINE.—*F.* bleu d'outremer; *It.* oltramarino; *Sp.* ultramar; *P.* azul ultramarino; *G.* Ultramarin; *Du.* berg blaauw; *Da.*, *Sw.* ultramarin; *R.* **ультрамаринъ**, ultramarīn; *Hind.*, *Guz.* lajvurd.

VANILLA.—*F.* vanille; *It.* vanilla; *Sp.* vainica; *P.* bainha; *G.* Vanille; *Du.* vanilje; *Da.* vanille; *Sw.* vanilj; *Gr.* βανίλια; *R.* **ваниль**, vaníl'.

VERDIGRIS.—*F.* vert-de-gris; *It.* verderame; *Sp.* cardenillo, verdin; *P.* verdete artificial; *G.* Grünspan; *Du.* kopergroen, groenspaan; *Da.* spanskgrönt; *Sw.* spanskgröna; *Gr.* χάλκανθος; *R.* **мѣдянка**, mêdyanka; *Arab.*, *Pers.* zungar; *Hind.* chungal; *Sans.* pittalata; *Tam.* vungalap-patchei; *Mal.* sennang.

VINE (*Lat.* vinea).—*F.* cep de vigne; *It.* vigna, vite; *Sp.* vid; *P.* videira; *G.* Weinstock, Rebe; *Du.* wijngaard; *Da.* viintræ; *Sw.* vinstock; *Gr.* ἀμπέλιον; *R.* **виноградъ**, vīnoghrádd.

VINEGAR (*Ags.* æced; *from Lat.* acetum).—*F.* vinaigre, *i.e.*, *sour wine*; *It.* aceto; *Sp.*, *P.* vinagre; *G.* Essig; *Du.* azijn; *Da.* eddike; *Sw.* ättika; *Gr.* ξύδιον; *R.* **уксусъ**, úksus; *Arab.* khull; *Pers.* sirka; *Sans.* canchica; *Hind.* sirka; *Tam.* cadi; *Cing.* cadidia; *Mal.* chooka; *Chinese*, tsoo.

VITRIOL (*Lat.* vitriolum).—*F.* vitriol; *It.* vitriuolo; *Sp.*, *P.* vitriolo; *G.* Vitriol; *Du.* vitriool; *Da.* vitriol; *Sw.* vitriol; *Gr.* βιτρίολιον; *R.* **купоросъ**, kuporóss; *Arab.* rohazim, maulkibrit; *Pers.* arika-gowgird; *Hind.* gunduck-ka-teil; *Tam.* ghendaga travagum; *Cing.* gandaka rasa.

WALNUT (*the* Wealh, *i.e.*, *foreign or Italian nut*).—*F.* noix; *It.* noce; *Sp.* nuez, nogal; *P.* noz; *G.* Wallnuss; *Du.* walnoot; *Da.* valnöd; *Sw.* valnöt; *Gr.* καρύδιον; *R.* **грѣцкій орѣхъ**, ghryêtskiĭ oryêx; *Arab.* akroot, jows, khusif; *Pers.* char-mughz, geerdighan, jouz-i-roomie; *Hind.* akroot.

WAX (*Ags.* wæx; *Lat.* cera).—*F.* cire; *It.*, *Sp.*, *P.* cera; *G.* Wachs; *Du.* was; *Da.* vox; *Sw.* vax; *Gr.* κηρίον; *R.* **воскъ**, vosk; *Arab.* shuma; *Pers.* moom; *Sans.* siktha; *Hind.* moom; *Tam.* meloogoo; *Cing.* miettie; *Mal.* lelin.

WHALE (*Ags.* hwæl; *Lat.* balena).—*F.* baleine; *It.* balena; *Sp.* ballena; *P.* balêa; *G.* Wallfisch; *Du.* walvisch; *Da.* hvalfisk; *Sw.* hval(fisk); *Gr.* κῆτος; *R.* **китъ**, kīt.

WHALEBONE.—*F.* baleine; *It.* balena; *Sp.* ballena; *P.* barba de balea;

Hosted by Google

G. Wallfischbein ; *Du.* balein ; *Da.* ñskebeen ; *Sw.* hvalben ; *Gr.* κητώδιον ; *R.* **китовый усъ,** kītovyĭ uss.

WHEAT (*Ags.* hwæte ; *Lat.* frumentum).—*F.* blé, froment ; *It.* formento, grano ; *Sp.*, *P.* trigo (*Lat.* triticum) ; *G.* Weizen ; *Du.* Tarwe ; *Da.* hvede ; *Sw.* hvete ; *Gr.* σιτάριον ; *R.* **пшеница,** pshenītsa ; *Arab.* hinteh ; *Pers.* gundum ; *Hind.* gaon.

WHITE LEAD.—*F.* blanc de plomb ; *It.* cerussa ; *Sp.* abbayalde, cal de plomo ; *P.* alvaiade ; *G.* Bleiweiss ; *Du.* loodwit ; *Da.* blyhvidt ; *Sw.* blyhvitt ; *Gr.* μολυβοπέτρα, ψιμμύθιον ; *R.* **бѣлила,** byêlila ; *Turk.* istibedsh ; *Arab.* asfeidaj ; *Pers.* suffeidah, kash ; *Hind.*, *Guz.* suffeïdah ; *Tam.* moothoo vullay.

WINE (*Ags.* wín ; *Lat.* vinum ; *Gr.* ὄινος).—*F.* vin ; *It.* vino ; *Sp.* vino ; *P.* vinho ; *G.* Wein ; *Du.* wijn ; *Da.* viin ; *Sw.* vin ; *Gr.* κρασίον, ὄινος ; *R.* **вино,** vinó ; *Arab.* khumr ; *Pers.* mei ; *Sans.* madira ; *Hind.* ungoor-ka-shurab.

WOAD (*Ags.* wád).—*F.* peindre au pastel, guède, vouede ; *It.* guado ; *Sp.* gualda, yerba pastel ; *P.* pastel ; *G.* Waid ; *Du.* weede ; *Da.* vaid ; *R.* **синильникъ,** sīnĭl'nīk.

WOOD (*Ags.* wudu).—*F.* bois ; *It.* legno ; *Sp.* leña, palo ; *P.* pao, lenha ; *G.* Holz ; *Du.* hout ; *Da.* træ ; *Sw.* trä ; *Gr.* ξύλον ; *R.* **дерево,** dérevo.

WOOL (*Ags.* wól ; *Lat.* lana).—*F.* laine ; *It.*, *Sp.* lana ; *P.* laa ; *G.* Wolle ; *Du.* Wol ; *Da.* uld ; *Sw.* ull ; *Gr.* μαλλίον ; *R.* **шерсть,** sherst' ; *Pers.* pushm ; *Hind.* oonn.

WORMWOOD (*Ags.* wermod ; *Lat.* absinthium).—*F.* absinthe ; *It.* assenzio ; *Sp.* axenjo ; *P.* absinthio, losna ; *G.* Wermuth ; *Du.* alsem ; *Da.* malurt ; *Sw.* malört ; *Gr.* ἄψινθος ; *R.* **полынь,** polýn' ; *Arab.* afsunteen ; *Pers.* buranjasif kowhei ; *Sans.* dona ; *Hind.* dhowna, murwa, mustaroo ; *Tam.* mashipattirĭ ; *Cing.* wael kolundoo.

ZINC, or SPELTER (*Ger.*).—*F.* zinc ; *It.*, *Sp.*, *P.* zinco ; *Sp. also* zinc, zinque ; *G.*, *Du.* Zink ; *Da.*, *Sw.* zink ; *R.* **цинкъ, шпіаутеръ,** tsīnk, shpiáuter ; *Pers.*, *Hind.* jussud ; *Tam.* tutu-nagum ; *Chin.* pi-yuen.

Hosted by Google

GEOGRAPHICAL DISTRIBUTION OF FOOD AND INDUSTRIAL PLANTS *(see Coloured Diagram).*

THE science of botanical geography, first sketched by Humboldt about sixty-five years ago, yet remains in a very imperfect state. De Candolle and Schouw have mapped out the whole surface of the globe into botanical kingdoms, and selected in each one or two types of vegetation so superabundant as to give a marked feature to that portion of the landscape. Unfortunately these maps are not now correct, according to the most reliable information; we have therefore selected, in preference, Meyen's climatal distribution of the plant world, which traces over the earth the gradual development of vegetation, from the lowest condition of organisation and development at the poles, to its highest organic perfection at the equator.

Meyen has divided the globe into eight botanical zones, as follows:—

8. The equatorial zone, or region of bananas and palms, extending 15° on either side of the equator.
7. The tropical zone, or region of figs and tree-ferns, from 15° of latitude to the tropics.
6. The sub-tropical zone, or region of myrtles and laurels, extending from the tropics to 34° lat.
5. The warmer temperate zone, or region of evergreen trees and shrubs, from 34° to 45° lat.
4. The colder temperate zone, or region of deciduous-leaved trees and shrubs, from 45° to 58° lat.
3. The sub-arctic zone, or region of coniferous trees, from 58° N. lat. to the Arctic circle.
2. The arctic zone, or region of alpine shrubs, extending from the arctic circle to 72° lat.
1. The polar zone, or region of lichens, mosses, and saxifrages, from 72° to the pole itself.

Now if the earth were throughout homogeneous, if its surface were not formed of land and sea, islands and continents, mountains and plains, then the temperature at any point of the globe would be found by the latitude, and isothermal lines, or lines of equal temperature, would be parallel to themselves and to the equator. But this is not so: temperature diminishes as land becomes elevated, and the proximity of the ocean affects temperature, countries near it being always cooler than those removed from its influence. The isothermal lines are therefore not parallel to the equator, as represented in Meyen's botanical zones, but, excepting in the neighbourhood of the equator, they form an irregular curve around the earth's surface.

Hosted by Google

These isothermal lines are decidedly preferable as boundaries, as they constitute the true belt of climate. We have therefore modified Meyen's subdivision.

The reader will understand that the limits of these zones are only approximate, and that the trees and shrubs mentioned as characteristic of one zone are often found extending into the next.

I.—FRIGID ZONE.

(*a*) POLAR ZONE.

1. *Region of Lichens, Mosses, Saxifrages.*

(*b*) ARCTIC ZONE.

2. *Region of Lichens, Mosses, Saxifrages, Alpine Shrubs, Dwarf Willows, and Birches.*

II.—TEMPERATE ZONE.

(*a*) SUB-ARCTIC ZONE.

3. *Region of Coniferous Trees.*

Food Plants—Iceland moss (*Cetraria*), barley, rye. *Tinctorial Plants*—Litmus (*Roccella tinctoria*), orchil, cudbear (*Lecanora*). *Timbers*—Spruce, Scotch fir, black walnut, boxwood, in Europe; hemlock, spruce, balsam fir, and juniper, in North America. *Gums and Resins*—Canada balsam, pitch, tar, turpentine, gum sandarach, frankincense.

(*b*) COLDER TEMPERATE ZONE.

4. *Region of Deciduous-leaved Trees.*

Food Plants—Wheat, oats, barley, rye, pea, chick-pea, lentils, horse-bean, French-bean, carrageen or Irish moss, beet, sugar-maple, hops, hazel, walnut, hickory, and chestnut, black and white mustard, onions, soy-bean, truffles, and morel. *Industrial Plants*—Flax, hemp, bast, linseed, rapeseed, lavender, thyme, peppermint, aniseed, and caraway. *Tinctorial Plants*—Alkanet root, madder, oak bark, quercitron, woad, and weld. *Medicinal Plants*—Camomile flowers.

(*c*) WARMER TEMPERATE ZONE.

5. *Region of Evergreen Trees.*

Food Plants—Maize, guinea-corn, rice, grapes, raisins, currants (*Vitis*), orange, bitter orange, lemon, citron, pomegranate, tamarind, prune, French plum, sweet and bitter almonds, tea, Paraguay tea or maté, ground-nut, carob-bean or St. John's-bread, star aniseed. *Industrial Plants*—Olive and castor-oil, nut-galls, cork, tobacco, liquorice, rushes, Dutch rushes, tinder, teazel, rice-paper.

Hosted by Google

(*d*) SUB-TROPICAL ZONE.

6. *Region of Laurels and Myrtles.*

Food Plants — Rice, maize, sugar-cane, dates, figs, pine-apples, tamarinds, pomegranates, grape, Brazil-nut. *Industrial Plants*—Cotton, New Zealand flax, jute. *Gums*—Arabic, Senegal, and tragacanth; asafœtida. *Medicinal Plants*—Opium, rhubarb, ipecac, sarsaparilla, senna, camphor. *Tinctorial Plants*—Logwood, sumach, safflower.

III.—TORRID ZONE.

(*a*) TROPICAL ZONE.

7. *Region of Figs and Tree Ferns*

Food Plants—Coffee, cacao, cocoa-nut and sago palms, arrowroot, tous-les-mois, and tapioca. *Spices*—Capsicums and cayenne pepper, chillies, ginger, cardamoms, vanilla, cloves, allspice. *Industrial Plants*—*Timbers*—mahogany, lignum-vitæ, cedar, lancewood, rosewood, satin wood, snakewood, ebony, East India ebony, sandalwood. *Tinctorial Plants*—Logwood, myrobalans, indigo, turmeric, sappan-wood or bukkum, red sanders wood. *Medicinal Barks*—Peruvian bark, cascarilla bark, cedron, quassia. *Medicinal Plants*—Aloes, jalap, strychnos. *Textile Plants*—Cotton shrub, cotton tree.

(*b*) EQUATORIAL ZONE.

8. *Region of Palms and Bananas.*

Food Plants—Banana, plantain, cocoa-nut. *Spice Plants*—Cinnamon, bastard cinnamon, nutmeg, mace, cloves, pepper, long pepper, allspice. *Industrial Plants*—Gums, catechu, caoutchouc, gutta-percha, gamboge. *Textile Plants*—Manilla hemp, coir-fibre. *Miscellaneous plants of commercial value*—Croton oil (*Croton Tiglium*), coquilla nut, marking nut, vegetable ivory, palm oil (*Elais Guineensis*, and *E. melanococca*) arnatto, betel nut, divi-divi.

Hosted by Google

GLOSSARY

OF THE

PRINCIPAL TECHNICAL AND SCIENTIFIC TERMS.

Acuminated. Tapering to a point.

Albumen. Nutritive matter for the support of the embryo, deposited in many seeds; sometimes, as in the case of the grasses, constituting their chief bulk.

Alluvium. The mass of loam, clay, or other earthy materials accumulated by aqueous agencies, such as are found in valleys and plains.

Alternate leaves are situated at different heights on either side of the stem.

Amorphous. Applied to minerals having no determinate form, and without crystalline structure.

Anhydrous. Applied to minerals and chemical compounds, when water does not enter into their composition.

Annulated. Ringed.

Antennæ. A pair of jointed appendages proceeding from the heads of insects.

Anther. See *Stamen.*

Anti-spasmodics. Medicines which counteract spasms or convulsions.

Areola. A small shallow cavity.

Argillaceous. Of the nature of argil or clay.

Arillus. An expansion of the seed-stalk over the outer surface of the seed.

Axillary. Growing in the axilla of a leaf or bract; that is, in the angle formed by the leaf-stalk and stem.

Basalt. A volcanic rock, consisting of augite and felspar, of dark colour and high specific gravity.

Bed. An extended layer of mineral or rock.

Bi-pinnate. Twice pinnate.

Bituminous. Containing bitumen, an inflammable material of organic origin.

Botryoidal. Applied to minerals presenting an aggregation of small globes, from resemblance to the form of a bunch of grapes.

Bract. The abortive leaf at the base of a pedicle or flower-stalk.

Branchial. Appertaining to the branchiæ, or gills, the respiratory organs of those animals which breathe through the medium of water.

Calyx. The outermost of the floral envelopes.

Capsule. A dry hollow seed-vessel, dehiscing or opening by regular valves or seams.

Carbonaceous. Pertaining to coal.

Cartilage. Animal substance, commonly termed gristle.

Caryopsis. A fruit having a very thin indehiscent pericarp, closely adherent to the surface of the seed.

Catkin. A deciduous spike. Example: Willow.

Cellular. A tissue composed of membranaceous cells or cavities.

Hosted by Google

INDEX.

Acalephæ, or jelly-fishes, 345.
Acanthopterygii, or spiny-finned fishes, 318.
Acid, sulphuric, 383.
Adaptation of animals and plants to different climates, 124, 125.
Africa and Southern Asia, vegetable and animal produce of, 102.
Agate, 385.
Alabaster, 374.
Albite, 376.
Alkanet, 210.
Alligator, 315.
Allspice, 146, 147.
Almond, sweet, 188; bitter, 189; oil of, 208.
Aloes—Socotrine, Barbadoes, Cape, Caballine or horse, 242.
Alpaca, 292.
Alum, its compounds, 380.
Aluminum, 364.
Amber, 371.
Ambergris, 280.
Amethyst, 385.
Amphibia, products of class, 317.
Analogues, European, of Great Britain, 60—63.
Analogues, of mining industry, 60; animal produce, 61; vegetable, 62.
Anchovy, 57, 320.
Angelica, 154.
Angora goat, 291.
Aniline colours, 4.
Animal kingdom, commercial products of, 257—348.
Animals, their diffusion through human agency, 124.
Anise-seed, star, 154; oil of, *ib.*, and 209.
Annuloida, 332.
Annulosa, products of sub-kingdom, 332; classification of, *ib.*
Antimony, white, 364; valuable alloys of, *ib.*; grey, 365; statistics, *ib.*
Anthracite coal, 369.
Antlers, 305.
Appendix, 387—420.
Apple, 52.
Aqueous rocks, 21.
Arable husbandry, districts of, 55.
Arachnida, 333.
Arctic and sub-arctic zones, British Colonies, 66; Russia, 91.
Argillaceous substances, 377.
Arnotto, or arnatto, 211.
Arrack, 158.
Arrowroot, 139.
Arsenic, metallic and medicinal, 366; its chemical combinations, *ib.*
Articulata, 332.
Asafœtida, 232.
Asbestus, 376.
Ash of plants, analysis of, 35, 36.
Asia, climate, soil, and raw produce, 96—104.
Asphaltic deposits, 369; asphaltum or asphalte, 370.
Australia, South, its chief produce, 68.
Austria, forests of, 81; its mineral, animal, and vegetable produce, 82.
Aves, products of the class of, 307—314; classification, 307—309.
Axolotl, 317.

B

Bacon, 285.
Badger, 272.
Baleen, or whalebone, 304.
Balsa, 249.
Balsam, Canada, 225.
Baltic, its navigation, 91.
Bamboo, 253.
Banana, 185, 186.
Barbadoes aloes, 242.
Barilla, 250; sweet, *ib.*
Barks of commerce, 233—235; Peruvian, 233; Cascarilla, 234; oak, crown, cedron, Calisaya, 235.

Hosted by Google

Barley, 131; used for malting and distilling, *ib.*; antiquity of, *ib.*
Baryta, sulphate of, 372.
Basaltic rocks, 377.
Bast, 254.
Bath brick, 376.
Bean, horse, 137; French, *ib.*; carob, 138.
Bear, brown, black, grizzly, polar, 272.
Beaver, 275.
Bed feathers, 312.
Bee, honey, 338; queen bee, how distinguished, *ib.*; drones and workers described, *ib.*; economy and habits of the hive bee according to Newman and Huber, 339—342.
Beef, salted, 285.
Beer, 177.
Beer and butter countries, 83, 84.
Beet-root sugar, 158.
Belgium, its geology and mineral produce, 39.
Beluga, or white whale, 283.
Berg-mehl, 376.
Beryl, 385.
Betel nut, 237.
Beverages, stimulating and nutritious, 159—178.
Bitumen, 370.
Bituminous substances, 371.
Black-lead, 383.
Blende, or black-jack, 363.
Blind worm, 315.
Blister fly, 343.
Bogs, 42.
Bone, 307.
Borax, 381.
Boron, earths of, 381.
Botanical regions of the United Kingdom, 16; Iberian or Asturian, *ib.*; Armorican, 17; Germanic, *ib.*; Boreal, 18; chart of, 19.
Boxwood, 222.
Brachiopoda, 326.
Brazilian pebbles, 374.
Brazilletto wood, 218.
Brazil nut, 188.
Brazil wood, 218.
Bricks, 378.
Bristles, 300.
British husbandry, special objects of, 49; colonies and possessions, produce of, 64.
Bronze, 361.
Buffalo, American, 277.
Buff leather, 296.
Building and furniture woods, 220; building and architectural stones, where quarried, 31.
Bukkum wood, 219.
Bulrushes, 253.
Butter, 284.
Byssus, gloves, caps, socks, manufactured from, 328.

C

Caballine or horse aloes, 242.
Cacao, or cocoa, description of the plant, and the cocoa bean, 172; chocolate, how prepared from, 173; varieties of chocolate imported, *ib.*; statistics, 174; adulteration of cocoa and chocolate, *ib.*
Cachelot, 28.
Cairngorm stones, 385.
Calamine, 363; electric, *ib.*
Calcareous substances, 372; sand, 374.
Calf, fœtal, skin of, 278.
Calf-skin, 297.
Camel's-hair, 299.
Camphor, 232.
Canastras, 241.
Canes, Malacca, 253.
Cantharides, 343.
Caoutchouc, 226.
Cape aloes, 242.
Capsicum, 149.
Caraway seed, 153; oil of, 209.
Carboniferous strata, 23; limestone, 25.
Carboniferous system, 27.
Cardamoms, 151.
Carmine and lake, how made, 344.
Carnelian, 385.
Carnivora, 262.
Carob bean, 138.
Carrageen, or Irish moss, 192.
Cascarilla bark, 234.
Cashmere, 291.
Cassia lignea, 143.
Cassowary, 308.
Castile soap, 206.
Castoreum, 280.
Castor oil, 204.
Cat, common, 265.
Catechu, 236.
Cattle rearing and dairy produce, Ireland, 44.
Cattle, English, 49.
Caviare, 325.
Cayenne pepper (*see* Capsicum), 149.

Hosted by Google

Cedar, American, 223; pencil, *ib.*
Cedron, 235.
Celestine, 382.
Cements, composition of, 374.
Central America, 71.
Cephalopoda, 326.
Cereals of temperate climates, 128—134; warm climates, 132—137.
Cetacea, 259.
Ceylon, 71.
Chalcedony, 385.
Chalk strata, 23; French, 376.
Chamois leather, 296.
Chart of temperatures, 13; botanical geography, 19.
Cheese, 284.
Cheiroptera, 259.
Chelonia, 315.
Chestnut, 188.
Chick-pea, 138.
Chicory, 171.
Chillies, 149.
Chinchilla, 276.
Chlorine, 380.
Chocolate (*see* Cacao, or Cocoa), 172.
Chromium, 367; ores of, where occurring, *ib.*
Cider, 52.
Cinnabar, 360.
Cinnamon tree, description of, 141; Choliahs, how they obtain the cinnamon, 142; a cinnamon garden scene, *ib.*; statistics, 143; bastard cinnamon, *ib.*
Citron, 179.
Civet cat, 279.
Clay and allied substances, 377; ironstone, 354; yellow, brown, blue, 378; pipe clay, fine and Stourbridge clays, 378.
Climate of United Kingdom, 11; diversity of temperature, 12, 13; diversity of rainfall, 13, 14; causes of diversity, 15.
Climatic zones of British colonies, 65; of Europe, 72; climatic changes, 122, 123.
Clove, 145; plantations described, 146; cloves, good, how to distinguish, *ib.*
Coal, not used by the Greeks and Romans, 3; national benefits derived from its use, *ib.*; geological formations in which it occurs, 27; value of geology in coal-mining, *ib.*; failures in mining for coal through ignorance of geology, 28, 29; coal statistics of the United Kingdom for 1867, 41; anthracite coal, 369; parrot, 368; steam, *ib.*; bituminous, 369; coal statistics of the world, 371.
Cobalt, 365.
Cochineal, 343; dyes, 344; quantity imported, *ib.*
Cockle, 332.
Cocoa. *See* Cacao.
Cocoa-nut palm, 189; its great utility in the countries in which it grows, 190; oil of, 204.
Cod, 57, 322; fisheries, 323; London market, how supplied with fresh cod, *ib.*; statistics of cod, ling, and haddock, *ib.*;
Cœlenterata, products of sub-kingdom, 345—347; classification of, 345.
Coffee, early use of, by the Persians, 5; description of the plant, 166; coffee harvesting, 167; chemical principle rendering coffee nutritious and stimulating, 168; history of coffee, *ib.*; coffee-houses in Turkey, 169; how to detect adulteration, 171.
Coir-fibre, 201.
Columbidæ, 308.
Commercial plants, miscellaneous, 246—255.
Conchifera, 326.
Condiments, plants yielding, 141—155.
Coontie, 139.
Copal resins, 372.
Copper, 361; principal ores, *ib.*; countries where found, 362; statistics, *ib.*
Coprolites, where found, 31; a source of phosphate of lime, 384.
Coquilla nut, 246.
Coral, red, fisheries of, 346; ornamental articles made from, *ib.*; varieties of stony coral, *ib.*
Coralline limestone, 373.
Coriander seed, 153.
Cork, obtained from cork oak, 247; countries whence imported, *ib.*; when removed from the tree, *ib.*; how made into bottles, corks, and bungs, 248; other appliances and manufactures from cork, 249; quantity annually imported, *ib.*
Corozo nuts, 246.
Corundum, 385.

Hosted by Google

Cotton-seed oil, 208.
Cotton-wool, 196, 197; its culture, 198; bales imported into United Kingdom in 1866, *ib.*; foreign cotton, 199; value of cotton, 200; chief seats of cotton manufacture in United Kingdom, *ib.*
Cowries, 327.
Coypu-rat, or nutria, 276.
Crabs'-eyes, 247.
Crane, 308.
Cretaceous rocks, 23, 24.
Crocodiles, 315.
Croton oil, 207.
Crustacea, commercial products of, 334.
Cryolite, 364.
Cudbear, 220.
Cumin, 154.
Currants, or Corinth grapes, 181.

D

Dabs, 324.
Dairy husbandry, districts of, 55.
Danube, region of, 81; its vegetable, mineral, and animal products, 82.
Date, sugar, 158; palm, 102, 185.
Daubeny, Dr., experiments of, 37.
Deal, white and yellow, 225.
Deer, skins of, 297.
Devonian formation, 26, 27.
Diamond, 384.
Diffusion of plants and animals through human agency, 123.
Digitigrade carnivora, 263.
Diorite, 26.
Divi-divi, 236.
Dog, common, 265.
Dolomite, or magnesian limestone, where found in England, 33; the Permian group of rocks, 372.
Duck, eider, 312.
Durra, 136.
Dutch rush, 254.
Dyes and pigments, 327.

E

East Indian Islands, 71.
Ebony, 321; East Indian, 222.
Echinus, or sea-egg, 345.
Edentata, 260.
Eggs of rasorial birds, 309; turtle, 317.
Egyptians, arts known to them in ancient times, 5.
Eider down, 313.
Elephant, tusks and teeth of, 305.
Emerald, 385.
Empire, British, what it comprehends, 9.
Encrinital marble, 373.
Endogens and exogens, how distinguished, 6.
England, Emerson's description of climate of, 10.
Ergot of rye, 132.
Ermine, 267; the royal fur of England and Europe, 268.
Essential oils, how obtained, 210.
European climatic zones, 72.
Exogens and endogens, how distinguished, 6.

F

Farinaceous plants, 128—138.
Fauna and flora of Europe, gradations in, 94.
Feather, description of, 309; ornamental feathers of the ostrich, 310; little egret, *ib.*; great and white herons, 311; adjutant, *ib.*; worn as articles of clothing, *ib.*
Feathers, bed, eider duck and poultry, 312; statistics, 313.
Felspar, 376.
Felting, 260.
Fernambuck wood, 219.
Fibre, cocoa-nut, 190; coir, 201; Manilla hemp, 203.
Figs, 181; botanical structure of fruit, 182; medicinal properties of, *ib.*
Firs, Scotch, balsam, silver, hemlock, and Norway spruce, 225.
Fisheries, British, 56, 57; Newfoundland, 58, 323; Mediterranean seaboard, 80; Northern Europe, 93.
Fishes, classification of, 318.
Flax, common, 193; New Zealand, 201.
Flint, 374.
Flora of Europe, gradations in, 94.
Florence oil, 206.
Flounders, 324.
Flour, 129.
Flowers, English, of Asiatic origin, 101.
Fluor spar, 382.
Food substances for man and animals, 51, 52; food crops, 52; food plants, 128—192; food products, 284—288.

Hosted by Google

Forests of Scandinavia, 92.
Fowls, English, Asiatic origin of, 101.
Fox, red, 265; cross, 266; arctic, *ib.*; blue or sooty, *ib.*; black or silver, *ib.*; cossack, 267.
France, a manufacturing country, 79; its agricultural and mineral produce, 80.
Frankincense, 232.
French plums or prunes, 182.
Fruits, English, 53; foreign and fleshy, 78, 187; European, and of Asiatic origin, 101; wholesome and nutritious, 178—191.
Fuller's earth, 378.
Fuller's teazel, 252.
Fungus, poisonous, infesting rye, 132.
Furs, whence derived, and why suitable for clothing, 260; how prepared, 261; fur-bearing animals, 262.
Fustic, 218.

G

Galena, 362.
Gallipoli oil, 206.
Galls, Aleppo, 236.
Gamboge, 231.
Garnet, 385.
Gasteropoda, 326.
Gault, 33.
Geographical description of the United Kingdom, 9—19.
Geological formations, table of, 22; botanical aspect of, 32; geological proofs of a change of climate, 121, 122; structure of Great Britain, 23, 24; distribution of mineral veins, 24—27.
Geology, its connection with agriculture, mining, and manufactures, 20, 21; of Great Britain compared with that of other countries, 39.
Germany, political and geographical features of, 86; animal and vegetable produce, 87.
German Ocean, its shallowness, 10.
German silver, 366.
Ginger, 150.
Glutton, 273.
Goat, Angora, 291; Thibet, or Cashmere, 291; hair of, 299.
Gold, prediction of its discovery in Australia by Murchison, 25; the rocks and countries in which it is found, 26, 356; the principal gold fields, 357; statistics, *ib.*
Gothite, 353.
Granites, 376.
Grape, or vine, 174; as a fruit, 180.
Graphite, or plumbago, 383.
Great Britain, compared with other countries, 39; well supplied with coal and iron, 46; wild animals of, 50, 51.
Grebe, skin and feathers of, 311.
Greenstone, 377.
Ground nut, 137.
Guinea corn, 136.
Gulf stream, its beneficial influence on the climate of the United Kingdom, 15; its effects on the climate of North America, 107.
Gum-arabic, 230; senegal, tragacanth, 231; sandarach, *ib.*; copal, 371.
Gum elastic or caoutchouc, 226.
Gums, resins, and balsams, 225—233.
Gunny fibre, 200.
Gutta-percha applied to telegraphy, 4; how procured, 228; variety of articles manufactured from, *ib.*; destruction of gutta-percha trees, *ib.*
Gypsum, 374.

H

Haddock, 323.
Hæmatite iron ore, red, 352; brown, 353.
Hair and wool, felting of, 288; hair and bristles, 298—300.
Hair, nature of, 298; human, uses of, 299; horse, *ib.*; elk, *ib.*; goat, *ib.*; camel, *ib.*; statistics, 300.
Halibut, 324.
Hams, 285.
Hare, fur of, 277.
Hawk's-bill turtle, 316.
Hazel nuts, 187; oil of, 207.
Heavy spar, 372.
Hemlock spruce fir, 225.
Hemp, 194; its geographical range, *ib.*; its resinous secretion, *ib.*; used by the Fakeers and other religious devotees of India, 195; experiments of Dr. O'Shaughnessy, *ib.*; imports of hemp into United Kingdom, 196; uses of hemp, *ib.*
Heron, 308.
Herrings, fisheries of, 56, 319.
Hickory nut, 187.
Highlands of Scotland, geology of, 34.

Hosted by Google

Hippopotamus, tusks and teeth of, 306.
Hive-bee, natural history of, 338—342.
Hog bristles, 300.
Holland and Belgium, produce of, 85.
Hone stones, varieties of, 379.
Honey, 342; statistics, *ib.*
Hoofs, employment of, 304.
Hops, 48, 177, 178.
Hornblende, 376.
Horn silver, 358.
Horns and allied substances, 301; how prepared from the raw material, 302; articles manufactured from, 303; statistics of the horn trade, *ib.*
Horses, draught or dray, 49; wild, hides of, 297.
Howler monkeys, 262.

I

Igneous and metamorphic rocks, 21; mineral constituents of, 376.
India, its produce, 70.
Indian corn, 134.
India-rubber, 226.
Indigo, how obtained, 215; good, how known, 216.
Industrial and medicinal plants, 192—255.
Insecta, commercial products of, 334.
Insectivora, 259.
Insessores, 308.
Interchange, value of, 2.
Ipecacuanha, 243.
Ireland, raw produce, mineral, animal, and vegetable, 42—44.
Irish moss, 192.
Iron, its great value in the arts, 350; found in meteoric stones, 351; most abundant in palæozoic rocks, *ib.* Ores, magnetic, *ib.*; titaniferous, specular, micaceous, and kidney, 352; red and brown hæmatite, spathose iron, 353; clay, ironstone, iron, and auriferous pyrites, 354; phosphates and silicates, 355; statistics, 356.
Iron ores, chiefly in carboniferous system, 29; natural advantages resulting from their position, *ib.*; no iron manufactures in Ireland for want of coal, 30.
Isinglass, 325.
Italy, its produce, 80; prevalence of malaria in certain districts, *ib.*; mnier resources of, *ib.*
Ivory supplies, whence derived, 305; Chinese unrivalled ivory workers, 306; objects manufactured from, *ib.*; refuse of (noir d' ivoire), 307.

J

Jackal, 265.
Jaguar, 264.
Jalap, 116, 244.
Jasper, 385.
Jelly-fishes, 345.
Jet, 371.
Jurassic rocks, 32.
Jute, 200.

K

Kaolin, 378.
Kelp, 250.
Kid leather, preparation of, 296.
Kildare, Curragh of, 43.

L

Lac, varieties of, 344; lac insect, *ib.*
Lacertilia, 315.
Lambs, imported from Holland, 285; skins of, 278.
Lamprey, 324.
Lancewood, 223.
Lanterns, Chinese, 302.
Lapis-lazuli, 385.
Lapland and Finmark, 91; reindeer, wealth of rich Laplander, *ib.*; winter in, 92; forests of, *ib.*; revival of industry in summer, 93.
Lard, 285, 377.
Lavender, essential oil of, 209; water, scented with civet, 279.
Lead, 362; chemical combinations of, *ib.*; ores of, *ib.*; statistics, 363.
Leather, nature of, 294; dressing of, *ib.*; tanning, 295; Russian and Morocco leather, 297; statistics of, 298.
Leech, where found, and how taken, 333; great extent of the trade, 334.
Leguminosæ (pulse family), 137, 138.
Lemon, 179.
Lentils, 137.
Leopard, 264.
Lias, 23.
Lignite, 368.
Lignum vitæ, 222.
Lime (*vegetable*), 180; carbonate of, 372.
Limestone, common, 372; ornamental, *ib.*; mountain, *ib.*; magnesian, *ib.*
Ling, 323.
Linseed oil, 206.

Hosted by Google

Lion, 263; American, 264.
Liquorice, 243.
Litmus paper, 220.
Live stock, 285.
Lizard, green, 315.
Llama, 293.
Llanos, or plains of the Orinoco, 109.
Lobster, 333; Norwegian, 324.
Logwood, 213.
Lupulin, 177.
Lynx, European, and Canadian, 264.

M

Mace, 144.
Mackerel, 321.
Madder, 214.
Madrepore marbles, 372.
Magnesian limestone, 372.
Magnetic iron ore, 352.
Mahogany, 220, Spanish, Honduras, 221.
Maize, important crop about Mediterranean, 4; description of, 134; geographical range, 135; introduced to Europe from America, *ib.*; cornbread, hominy, and pop-corn, 136; corn cobs, *ib.*; quantity of maize imported into United Kingdom in 1866, 136.
Malacopterygii, or soft finned fishes, 318.
Mammalia, products of the class, 259—307
Manganese, 367; ores of, *ib.*
Manilla hemp, 203.
Manioc, 116.
Maple sugar, 158; bird's eye maple, 223.
Marabou feathers, 311.
Marble, variegated, 372; entrochal, or encrinital, 373; black, Derbyshire, white or statuary, Purbeck and Petworth, Carrara, *ib.*
Marking nut, 246.
Marl, 373; varieties of, 374.
Marten, pine, stone, beech, 270.
Maté, or Paraguay tea, 165.
Meat, preservation of, 286—288.
Medicinal products, miscellaneous, 242—245.
Mediterranean sea-board, 79.
Mercury, 360.
Mesta, institution of the, in Spain, 79.
Metals and metalliferous minerals, 389.
Metamorphic and igneous rocks, 349.
Meteoric stones, iron a constituent of, 350.
Mica schist, 376; crystals of, *ib.*
Millet, Turkish, 136.
Millstone Grit, or Farewell Rock, 27.
Millstones, 375.
Minerals raised in Great Britain and Ireland in 1867, 40; minerals proper, 367—385.
Mining industry, analogues of, 60.
Mink, 269.
Modification of forms of life, 122.
Mohair, 291.
Molasses, 156.
Mollusca, products of the sub-kingdom, 325; classification of, 326.
Monkey furs, 262.
Monotremata, 260.
Morel, 191.
Mother-of-pearl, 329.
Mouflon, 288.
Mullet, 318.
Murchison, Sir R., on the discovery of gold in Australia, 25.
Muscovado sugar, 156.
Museums, utility of, 7.
Musk rat, or musquash, 276; deer, 278; bags, 279.
Mussels, 59, 332.
Mustard, 154.
Mustelidæ, family of, 297.
Myrobalans, 212.

N

Naphtha, 370; Burmese, *ib.*
Narcotic and poisonous plants, 237—242.
Narwhal, tusks of, 306.
Natron, 381.
Nature and man as agents of change, 121—125.
Nests, edible, 309.
New world, climate of, 105; botanical regions compared with the old, 106; animals and plants of the Old World represented in the New, 124, 125.
New Zealand flax, 201.
Nickel, 366; where found, *ib.*
Nitrate of soda, 382.
Nitre, or saltpetre, 382; cubic, *ib.*
Normandy and Picardy, rocks of, 39.
North America, physical and geographical features of, 106; its rich mineral resources, 110—112.
Northern grains, zone of, 90.
Norway, 40.

Hosted by Google

Nutgalls, 236.
Nutmeg, 144; indigenous to Malayan archipelago, *ib.*; attempt at monopoly by the Dutch defeated by wood pigeons, *ib.*; nutmeg and clove trees introduced as ornamental plants into England by Sir Joseph Banks, 145.
Nutrio, or coypu rat, 276.
Nutritious fruits, 178—191.
Nuts, 187—191.
Nux vomica, 241.

O

Oak bark, 235, 237.
Oakum, 196.
Oats, 124.
Obsidian, 377.
Ochre, red, yellow, 352.
Oil, palm, 204.
Oils, fixed, 204; essential, 208.
Old Red Sandstone, 32.
Oleaginous plants, 203—210.
Olive, representative of European subzone, 75; olive oil, 205.
Onion, 191.
Oolite, 23, 24; where quarried, 46; Bavarian oolite, 372.
Opal, 385.
Ophidia, or snakes, 315.
Opium, 237.
Orange, sweet, 178; bitter or Seville, 179.
Orchella weeds, or orchil, 219.
Orpiment, 366.
Orris root, 247.
Osseous substances, 305—307.
Ostrich, 310.
Otter, American, 271; sea otter, *ib.*
Otto of roses, 209.
Oyster culture, 58, 59; pearl, 329; edible, 331.

P

Pachydermata, 260.
Paddy, 134.
Palm oil, 204.
Palæozoic, or primary rocks, 22, 34.
Pampas, or treeless plains of La Plata, 110.
Panamá hats, 202.
Panther, 264.
Paraguay tea, 165.
Partridge, 308.
Pastoral and cattle-rearing districts, 55.
Pea, 137.
Peach wood, 218.
Pearl fisheries, 330; pearls, how valued, *ib.*; how produced artificially, *ib.*; spurious pearls, 331.
Pecan-nut, 187.
Pekan or wood-shock, 270.
Peltry, meaning of the term, 261.
Penguin, 311.
Pepper, black and white, 148; Jamaica, 146; long, Cayenne, 149.
Peppermint, oil of, 209.
Perfumes, 278—281.
Periwinkle, 332.
Perry, 52.
Peruvian bark, 233.
Petroleum, 370.
Petuntse, 378.
Pheasant, 308.
Physical features of northern and southern Europe, 73—95.
Pilchard, fisheries of, 57, 320.
Pimento (*see* Jamaica pepper), 146.
Pine-apple, 186.
Pinnigrade, 273.
Pipe-clay, 378.
Pisces, or fishes, cartilaginous, 318, bony, *ib.*
Plaice, 324.
Plantigradæ, 272.
Plants, inorganic constituents of, 35; peculiar to Asia, 103; introduced into Asia, 104; growth, how influenced by the soil, 34; diffusion of plants through the agency of man, 123; ornamental, introduced from America, 117.
Platinum, 357; its great usefulness in the laboratory, *ib.*; whence obtained, *ib.*
Plumbago, 383.
Polecat, 269.
Pomegranate, 184.
Population of United Kingdom, 54.
Porcelain, 375.
Porcupine quills, 300.
Pork, 285.
Potash, 249; bichromate of, *ib.*
Potato, Chilian, 4.
Poultry, 50.
Pozzuolano, 377.
Prawns, 58.
Precious stones, 384.
Produce, raw, defined, 3.
Products of animal kingdom, commercial, 251.

Hosted by Google

Protozoa, products of sub-kingdom, 347.
Prune, 182.
Psilomelane, 367.
Pteropoda, 326.
Puddling, process of, 355.
Puffin, skin and feathers of, 311.
Pulse, 137.
Puma, or American lion, 264.
Pumice-stone, 377.
Pyrites, mining of, 31; application of, in the arts, 381.
Pyrolusite, 367.

Q

Quadrumana, 262.
Quartz and flint, 374.
Quassia, 235.
Quercitron, 217.
Quicksilver, commercial, how obtained, 360; principal sources of supply, *ib.*
Quills, early use of, 5, 313; birds which supply them, 313; the principal sorts known in commerce, 314; steel pens, *ib.*

R

Rabbit, 277.
Raccoon, 272.
Ragstone, 379.
Rainfall in United Kingdom, diagram of, 14.
Raisins, 76.
Rangoon tar, 370.
Rapeseed oil, 206.
Raptores, 307.
Rasores, 308.
Rattans, 252.
Raw material, meaning of the term, 2; importance of a knowledge of, 2—5; produce, raw mineral, classification of, 349.
Ray, 318.
Realgar, 366.
Remora, 315.
Reptilia, products of class, 314; classification of, 315.
Resins, definition of, 225.
Rhubarb, 243.
Rice, 132; rice paper, 133; antiquity of rice culture, 134.
Robin, 308.
Rock crystal, 374.
Rodentia, 275.
Rose-wood, 224.
Rotten-stone, 375.
Ruby, 385.
Rum, 158.
Ruminantia, 277.
Rushes, soft, 254; Dutch, *ib.*
Russia, its physical and geographical features, 87; Peter the Great, improvements introduced by, 88; animal produce, 89; Central Russia, forests of, *ib.*; Russian produce, 90.
Rye, 131; forms excellent material for thatching, 132; poisonous fungus infesting, *ib.*

S

Sable, Russian, 268; American, 269; Tartar, 270.
Safflower, 212.
Sago, 140; how manufactured, 141; German, or potato sago, *ib.*
Salmon fisheries, 57, 321.
St. John's bread, 138.
Salt, common, 379; rock, 380.
Saltpetre, 382.
Sandal-wood, 222.
Sanders-wood, 224.
Sandpiper, 308.
Sandstone, varieties of, 375.
Sapan, or bukkum-wood, 219.
Sapphire, 385.
Sardines, 320.
Sardonyx, 385.
Sarsaparilla, 244.
Satin-wood, 224; satin gypsum, 374.
Saxony, 39.
Scansores, 308.
Schistose grits, 375.
Scotland, husbandry of, 48.
Sea fowl of Northern Europe, 92.
Seal, common bladder-nose, 274; saddle-back or harp, 273; oil of, 283.
Sealing-wax, varieties of, how produced, 345.
Selenite, 374.
Selvas, or woody plains of the Amazon, 109.
Senna, Alexandrian, East Indian, or Tinnivelly, Tripoli, 245.
Sepia, 327.
Septaria, or calcareous nodules, 374.
Serpentine, 377.
Sesame oil, 207.
Shark, 318.
Shawls, mohair, Cashmere, 291.

Hosted by Google

Sheep, English counties famous for, 50; Merino, 289; Cretan, or Wallachian, 290.
Shell-fish, 58.
Shells, domestic utensils made from, 327; wampum belts of Indians, *ib.*; structure of, 328; why iridescent, 329; value of the nacreous layer, *ib.*
Siderite, 352.
Silica, 374.
Silicious substances, 374; precious stones, 384.
Silkworm, moth and larva described, 334, 335; how silk is obtained from the cocoon, 335; history of silk cultivation, 336; countries which supply the United Kingdom with silk, 337; principal seats of the silk manufacture, *ib.*
Silurian formation, 25.
Silver ores, varieties of, 358; statistics, 359.
Skins of Beluga, 283.
Skiver, 298.
Skunk, 271.
Slates quarried in Silurian rocks in Wales and Scotland, 31; their commercial value, 378.
Snake-wood, 224.
Socotrine aloes, 242.
Soda, 249; how manufactured, 250.
Soils, nature of depending on subjacent rock, 20; how change in the soil affects the flora, *ib.*; agricultural capabilities of, derived from the materials furnished by various geological formations, 37; geological and chemical knowledge of soils, utility of, 38.
Sole, 324.
South Africa, 69.
South America, physical and geographical features of, 108; its mineral produce, 110; animal, vegetable, and indigenous produce, 113—118.
Spar, brown, 353.
Sparrow, 308.
Spermaceti, 282.
Sperm-whale, 282.
Spices, plants yielding, 141—155.
Sponge, fisheries of, in the Ægean sea, 82; organisation described, 347; universally distributed over the earth, *ib.*, sponge on living crab, 348, commercial varieties of, whence derived, *ib.*
Sprat, 57, 320.
Squirrel, 276.
Starches and starch-producing plants, 138—141.
Starches, how distinguished, 6; action of light and oxygen on, 139.
Stearine and oils, 281.
Steel, supply, and how prepared, 355.
Steel pens, 314.
Stereotype metal, composition of, 465.
Sterlet, 325.
Strontianite, 382.
Strychnos, or strychnine, 241.
Stuccoes, composition of, 374.
Sturgeon, 325.
Sucking-fish, 315.
Sugar, early use of by the Arabs, 5; sugar-cane described, 155; its geographical range, *ib.*; manufacture of sugar, 156; process of claying sugar, *ib.*; loaf-sugar, white, how made, 157; history of sugar-culture, *ib.*; countries now producing sugar, 158; statistics, *ib.*
Sulphur, earths of, 382.
Sulphuric acid, 383.
Sumach, 211.
Swan, 309.
Swine, 50.
Switzerland, can never be a mining country, 39; Alpine ridge of, 82; climate and soil, *ib.*; northern slope, 83.
Syenite, 376.

T

Talc, 376.
Tallow, 283; from Australia, 284.
Tamarind, 184.
Tanning materials, 235—237.
Tapioca, 139.
Tar, 228; Rangoon, 370.
Tartar lichen, 219.
Tea, description of plant, 159; varieties of green and black teas, 159, 160; how manufactured, 160; cultivation and gathering of the tea, 161; Chinese tea-merchants, *ib.*; how the Chinese and Japanese drink tea, 162; tea-chests and adulteration, *ib.*; consumption in the United Kingdom and by the Chinese, 163; caravan teas of Russia, 163; history of the tea-trade, 164; Assam tea, 165.

Hosted by Google

Teak, 102.
Teazel, 252.
Tellurine, 376.
Temperate zone, 66—68.
Terra-cotta, 378.
Tertiary rocks, 23, 34.
Textile plants, or plants from which we derive clothing and cordage, 192—203.
Thyme, essential oil of, 209.
Tiger, 263.
Tiles, 378.
Timber of the United Kingdom, 52, 53; foreign, 220—225.
Tin, 360; statistics, 361; tinstone and stream tin, 32.
Tinctorial plants, 210—220.
Tinder, 251.
Tobacco, 238; history of, 239; different varieties, how manufactured, 240.
Tonquin bean, 247.
Topaz, 385.
Torquilla, fibre of, 202.
Tortoise, 315.
Tous-les-mois, 139.
Trap, 377.
Trass, 377.
Tripoli powder, 376.
Tropical zone of the British empire, 69—72.
Trout, 318.
Truffle, 191.
Turbot, 324.
Turkey, 308.
Turkish millet, 136.
Turpentine, Bordeaux, Venice, Chio, Strasburg, 230; oil or spirits of, *ib.*
Turquoise, 385.
Turtle, green, 315; hawk's-bill, 316.
Type-metal, its composition, 365; stereotype ditto, *ib.*

U

Umbelliferous plants with aromatic fruits, 153.
United Kingdom, its latitude and longitude, 9; position relative to Europe, 10; Professor Ansted's description of its climate, 10, 11; diversities of temperature, 12; diversities of rainfall, 13; causes of this diversity, 15; botanical or floral regions of, 16—18; chart of the same, 19.

V

Valonia, 235.
Vanilla, 151—153.
Vegetable kingdom, commercial products of, Part II., 127—255.
Vegetable produce of Great Britain, analogues, European, 62, 63.
Vertebrata, definition of, 258.
Vine, its cultivation and natural range in Europe, 75; southern boundary of, 104.
Vitriol, 383.
Viverra zibetha, 280.
Vocabulary of European and Oriental names of products, 387—420.
Volatile, or essential oils, 208—210.

W

Wad, 367.
Wales, igneous and metamorphic rocks of, 21; sheep and cattle pastured on the hills of, 49.
Walnut, 187; black, 224.
Walrus, tusks of, 306.
Warm-temperate zones, 68—72.
Wash-leather, 296.
Waterford, trade of, 43.
Wax, bees', 342; white and yellow varieties of, how made, *ib.*; wax candles, *ib.*; anatomical preparations in wax, *ib.*
Wealden formation, 33.
Weasel family, 266—271.
West Indian possessions, 71.
West Indies, its geology and mineralogy, 112.
Whalebone, 304.
Whale fishery, 59; Greenland, hump-backed, pike or finned whale, 281; sperm, 282.
Wheat, 76, 128; wheat countries of Europe, 77.
Whelk, 332.
Whelk, Ormond, 332.
Whinstone, 377.
Whitebait, 320.
Wild animals of Great Britain, 50.
Wine countries of Europe, 74; process of wine-making (*see* Grape, 175); varieties of wine, 176, 177.
Winter in Russia, Lapland, Sweden, and Norway, 92, 93.
Woad displaced by indigo, 4; where cultivated, 218.
Wolf, 265.
Wolverine, 273.

Hosted by Google

Wood-shock, 270.
Wools, how divided in commerce, and how the term is understood, 288; alpaca, 292; Electoral, 293; Australian, *ib.*; extensive assortment of samples of wool at Great Exhibition, 1851, *ib.*

Y

Yellow berries, 217.

Z

Zaffre, annual yield of, 366.
Zinc, 363; ores, *ib.*; statistics, *ib.*
Zones, climatic, 65; wheat and northern grains, zone of, 66; zones, warm temperate, 68; tropical, 69; zones, floral, of the New World, vegetable produce of, 118—120.
Zamia, 139.

THE END.

PRINTED BY VIRTUE AND CO., LIMITED, CITY ROAD, LONDON.

Hosted by Google